APRIL 1955

Chemical Engineering

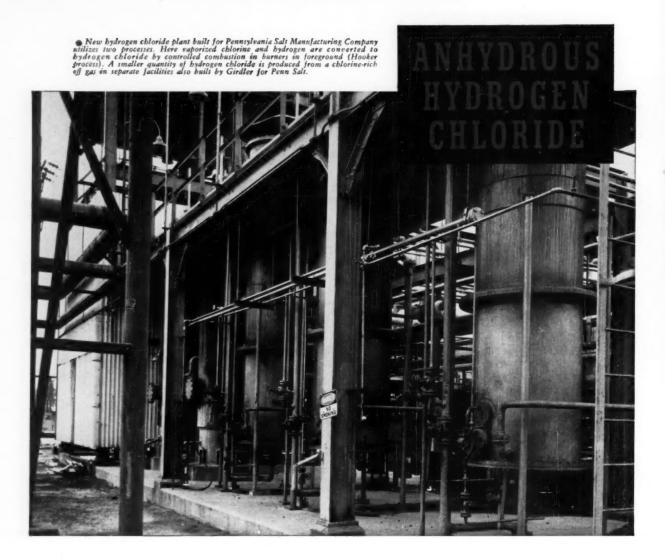
HOW TO INTERPRET

Kinetic Data

...the second step toward practical reactor design

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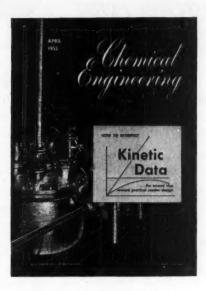
Chemical Processing Plants Sulphur Plants Hydrogen Production Plants Acetylene Plants Hydrogen Cyanide Plants Synthesis Gas Plants Carbon Dioxide Plants **Gas Purification Plants Plastics Materials Plants**

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CE is designed for chemical engineers—by chemical engineers.

Of our 17 editors, 15 have degrees in chemical engineering, two in organic or physical chemistry. Seven have advanced degrees. They hold a total of 27 degrees.

We also pick men with a background in industry; 16 of our editors have had one or more years of practical experience in the chemical process industries. Average is 6.2 years.

The 31 chemical processing firms they've worked for range from the largest to the smallest, from Allied Chemical & Dye to U. S. Cartridge. The products they've helped to make range from petrochemicals to plutonium, from penicillin to perfumes.

CE's editors have held jobs as chemical engineers in design, development, production, maintenance, equipment sales, cost estimating, process evaluation, market research.

Yes, CE is Jesigned by chemical engineers!—JEC

.. How to interpret kinetic data, vital step in practical reactor design.

This month, and for the next three months, Tom Corrigan shows how to get and to interpret kinetic data. In his popular "refresher" approach, Corrigan will point out pitfalls that can trap the unwary. He'll show how to calculate rate equations, test them, then use them to find the effects of process variables. This leads up to another Refresher theme—Fundamentals of Reactor Design—to start soon. (p. 199)



How labor trends will affect you.

Labor's plans to hit hard at the chemical industry will affect you and your job sooner than you think, whether you're in production, design, development or management. Here's a timely what's what. (p. 167)



Take a look at electric heaters.

They're now a major processing tool. Here is what every chemical engineer should know about the four basic types of



Please turn page



electric heaters, their advantages and limitations, where they can be used. (p. 191)



New charts for pressure vessels.

Four brand new nomographs offer you a quick way to get shell or head thicknesses for cylindrical and spherical pressure vessels. You can also use them to get maximum allowable pressure. (p. 172)



Beware tricky investment returns!

They can spell disaster for your plant if you haven't figured out what might happen when economic conditions change—and few engineers have! This dollars-and-cents analysis gives detailed data. (p. 195)



Worried about waste disposal?

Then you'll want to take a quick look at this survey of waste recovery and waste disposal methods now in use at processing plants. DuPont's Jacobs, well-known authority, scans the whole field. (p. 184)



Rejoin GUIDED TOUR page 276

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CHEMICAL ENGINEERING

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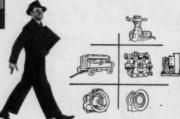


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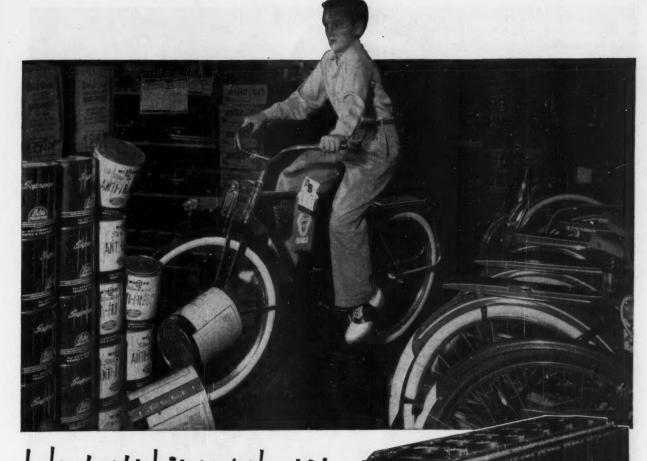
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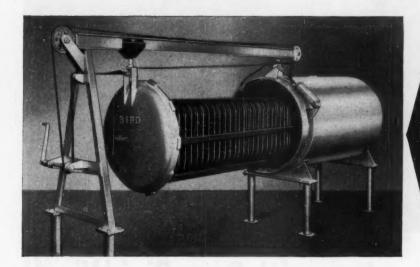
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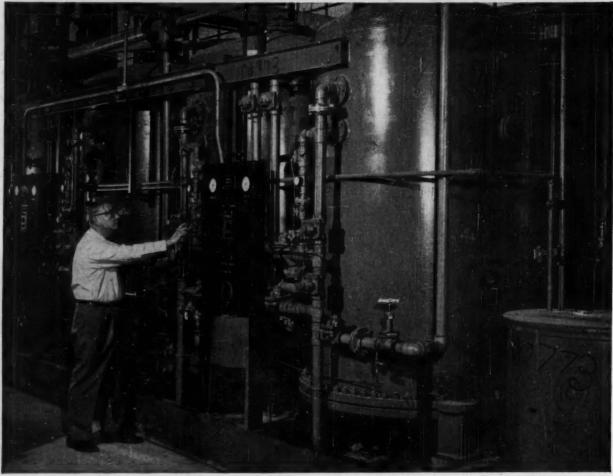
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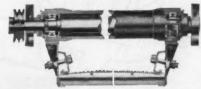
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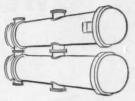
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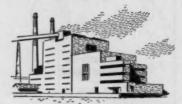


PROCESS PIPING

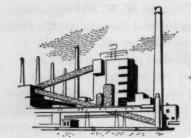


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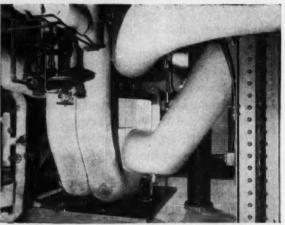
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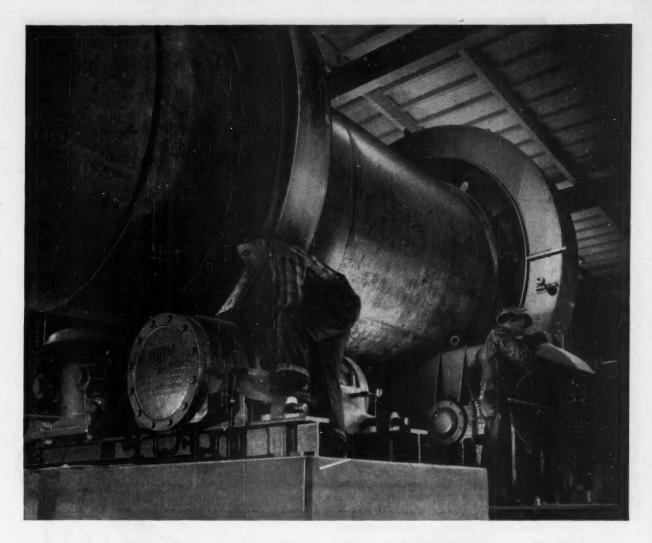
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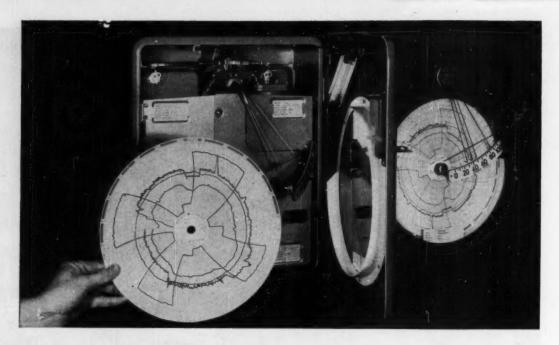
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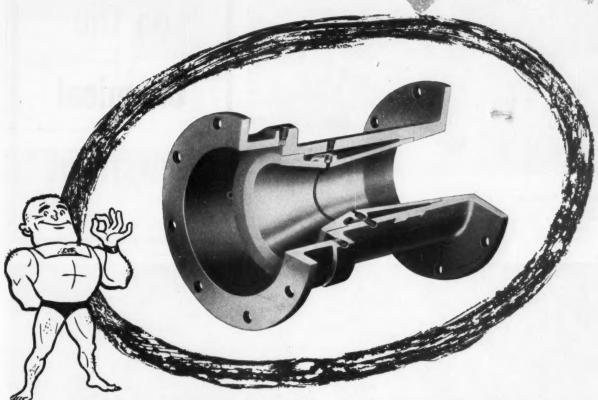
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Builders Dall Flow Tube reduces meter head loss where it counts...at the pipe line!

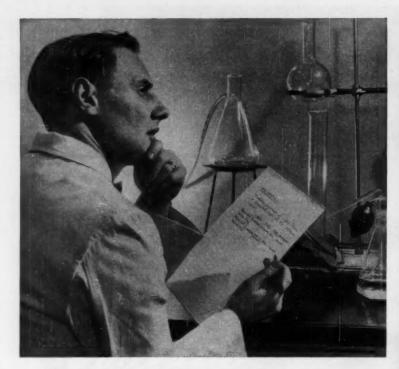
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Life on the Chemical Newsfront

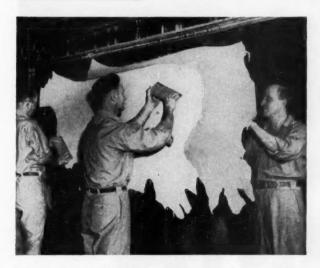


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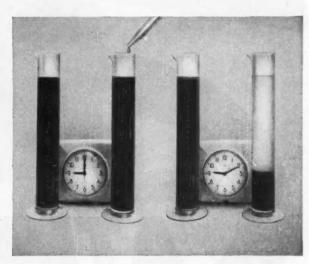
to vinyl popularity is the durability and long-lasting flexibility imparted by plasticizers made with Aero* Phthalic Anhydride, esterified with various monohydric alcohols. A new Technical Bulletin describing properties and many uses of Aero Phthalic Anhydride is now available. (No. 2)



ADHESIVES MADE WITH POLYACRYLAMIDE have greater tack when wet, higher strength and water resistance when dry. Slippery by nature, polyacrylamide solutions spread evenly and smoothly thus increasing the adhesive bond. Treatment of surfaces with polyacrylamide facilitates stripping of pressure sensitive tapes and other adhesives. Polyacrylamide, modified by reaction with formaldehyde, yields resins suitable for binding agents in brake bodies, clutch discs, and grinding discs. (No. 3)



WHITE LEATHERS STAY PLUMP AND ROUND through the pasting and drying process with Cyanamid's Tanak® MRX watersoluble melamine resin in tanning solutions. After permeating the leather, Tanak MRX polymerizes to large stable molecules which impart good filling to the stock. The result is leathers with a tighter break, thicker grain and better temper. This gives more footage on the drying plates and permits deeper buffing to remove grain defects without sacrificing normal grain thickness. (No. 4)



AEROFLOC® REAGENTS greatly increase settling and filtration rates by efficient flocculation of aqueous suspensions of ores, mineral and metal particles, industrial wastes, and chemical precipitates. Test illustrated above shows effect of a few parts per million of Aerofloc Reagent in specimen on right after standing for 10 minutes. First used in the mining industry, Aerofloc Reagents now are finding wide application in many other industries. (No. 5)

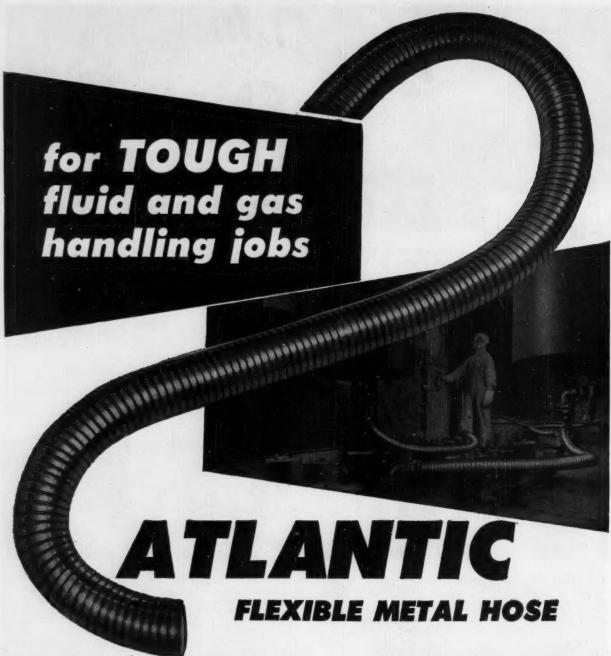
SEND more information on the following items mentioned
in the April, 1955 issue of LIFE on the Chemical Newsfront:
No. 1, 2, 3, 4, 5.
Literature Prices Sample of

Name____

Company

 AMERICAN Cyanamid COMPANY

30 ROCKEFELLER PLAZA
NEW YORK 20, NEW YORK



Conveying nitric acid for use in batch nitrations is quick death for ordinary flexible metal hose. Sulphuric acid and plating solutions are other notorious killers. When temperature and pressure extremes and adverse handling conditions are also involved, hose replacement is frequent and expensive.

That's why—for tough jobs—it's good economy to specify Atlantic flexible metal process hase. Manufactured to survive the most destructive use, it is unequalled for leak-proof qualities, flexibility, durability, strength and lightness. It performs long after ordinary hase is scrapped and returns real savings in your material and lobor dollar.

Whatever your application — conveying, controlling movement and vibration, correcting misalignments, compensating for expansion and contraction — there is an Atlantic flexible metal hose that is best for it.

Available in Seamless or Interlocking construction: Steel, stainless steel, monel, branze. 14"-36" I.D. Inclusive with appropriate fittings.

Our engineers have developed flexible metal hose for a number of classified nuclear applications. Though these types cannot be released at present, the experience gained is available for any unusual problems you may have.

Write for Chemical and Process Industries Bulletin 20D.

See our Catalogs In Sweet's Files for Product Designers and Mechanical Industries.

ATLANTIC

ATLANTIC METAL HOSE CO., INC. 329 Dyckman St., New York 34, N. Y.

April 1955—CHEMICAL ENGINEERING

Right down the line CHAPMAN CHEMICALS



Wood preservatives Millwork preservatives **Termite insecticides** Soil poisons **Crop insecticides** Industrial chemicals

A large and varied line of chemicals-for industry and agriculture-are shipped from the plant of the Chapman Chemical Company in drums and pails equipped with Tri-Sure* Closures - to protect their uniform purity, and the Chapman reputation for quality.

Companies, like Chapman, whose products must meet the most exacting requirements, are proving that good protection is an essential part of good selling. They protect every gallon-in steel containers of every size-with Tri-Sure Closures.

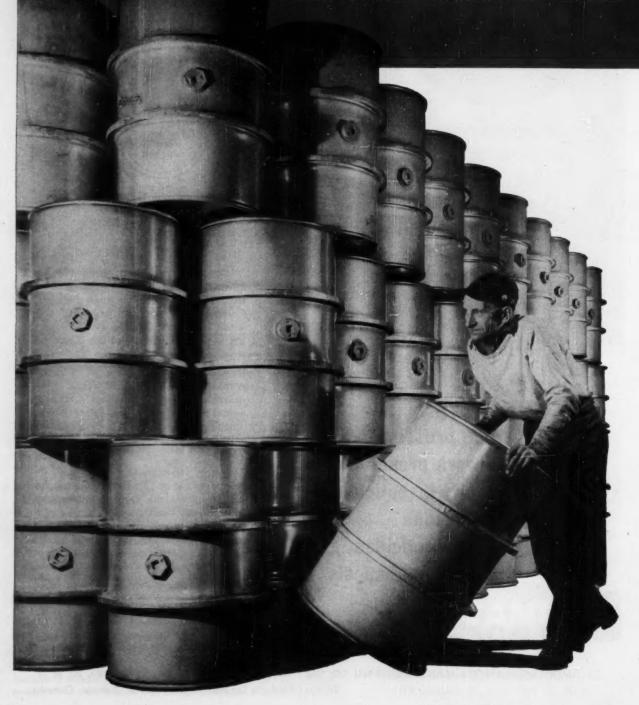
Give this protection to your products by standardizing on Tri-Sure Closures: for drums, the leak-proof, tamperproof Tri-Sure combination-flange, plug and seal; for pails and cans, a complete line of tested screw caps, nozzles and spouts that make containers easier to fill, protect and pour.

When you order drums, pails or cans, make sure of safe shipments by specifying "Tri-Sure Closures."

*The "Tri-Sure" Trademark is a mark of reliability backed by over 30 years serving industry.

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y. Tri-Sure Products Limited, St. Catharines, Ontario, Canada

Safety for your products in handling ...with REPUBLIC steel



and shipping drums and pails

Double safety, you might say-

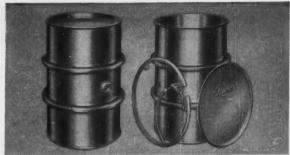
- 1. Because these steel drums are strong and sturdy, made to resist rough handling and abuse, to provide long service life at low cost. Their welded or double-seamed, leak-proof construction is based on many years experience in building steel drums and barrels for every use.
- 2. Because a variety of metals and finishes provides product protection for a wide range of chemical, food and other products, insures against contamination and spoilage.

Republic Steel drums and barrels are made of ENDURO Stainless Steel, hot dipped galvanized steel, hot dipped tinned steel, mill galvanized sheet steel, hot rolled open hearth steel, plain or lacquer lined. You have a choice of gages to meet all handling and shipping requirements, as well as many styles in sizes up to 55 gallons.

Take the first step toward added safety for your products by mailing the coupon for further information.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products



TOP PROTECTION COMES WITH ENDURO, Republic's versatile stainless steel. Drums and barrels made of it neither affect nor are affected by most chemical and food products, help maintain original color, flavor and purity of product. ENDURO resists corrosion, never needs painting, is tough and strong, lasts indefinitely. And its smooth surface is so easy to clean and keep sanitary. The solid head drum and Ringlok removable head drum above are two of many types available.



HERE'S TUBING YOU CAN DEPEND ON. It's ELECTRUNITE Carbon Steel Heat Exchanger Tubing, made under close control from the time the are is mined until the tubing is shipped to the user. Every length must pass rigid tests and conform to the applicable specification. In carbon steel it is generally produced in sizes up to 2# O.D., to ASTM specification A-214; in sizes 2# O.D. and above to ASTM specification A-178; or to your specification. Also available in various stainless steel analyses for use where corrosion is a factor. ELECTRUNITE Stainless Steel Pipe is produced to IPS schedules 40S, 10S and 5S.



SAFTY FOR WIRING IN CHEMICAL PLANTS is assured by Republic's "Dekaron-Coated" Electrical Metallic Tubing. The raceway and switchgear shown above get a 24-hour-a-day drenching in hydrochloric acid fumes in a Michigan plant. Within a six-month period, the unprotected switchgear had to be replaced twice — but 15 months after it was installed, Republic "Dekoron-Coated" E.M.T. had not changed physically. It is a zinc-coated steel raceway protected by a plastic armor of polyethylene.

REPUBLIC 51 3116 East 4 Cleveland 2	5th Street	DRATION	REPUBLIC	
Please send me	more inforn	nation on:		
Republic Ste	el Drums	Republic "E.M.T.	ekoron-Coated®"	
□ ENDURO® : Steel		ELECTRUN Exchanger T		
□ ELI	CTRUNITE	Stainless S	teel Pipe	
Name	Title			
Company				
Address				

POLY-CELL

An Entirely New Type of Insulation Insul-Mastic
#4010
Insulation's most
durable vapor barrier

JUST SPRAY . . . IT FOAMS AND STICKS!

- NO CUTTING
 AND FITTING
- NO MECHANICAL
 FASTENING



KEEPS YOUR
 INSULATION DRY . . .
 YOUR VESSELS
 FREE FROM RUST

Save time insulating valves, fittings and other irregular surfaces. Save on flat areas, too. Fifteen minutes after spraying, POLY-CELL foams to ½ inch, 1 inch or any thickness of insulation you desire. It resists acids, alkalies, solvents, sun and other forces.

POLY-CELL's K factor at 75 F. is 0.24 B.t.u. per hour, per square foot, per inch thickness per degree F. Its temperature limit is 225 F., and the density is 2.25 lbs. per cubic foot.

In the field or on the production line POLY-CELL is quickly applied wherever you can point a spray gun.

What proof of INSUL-MASTIC's quality would you like... applications many years old; laboratory vapor barrier and corrosion tests; successful applications in extremely moist or corrosive areas? We can show you all of these. INSUL-MASTIC bituminous coatings have proven their resistance to time, water vapor and most chemicals.

Before you specify, talk to an INSUL-MASTIC technical consultant about vapor barriers, waterproofing, corrosion prevention and insulation. Obtain proper coating recommendations now. There is no obligation for our technical service.

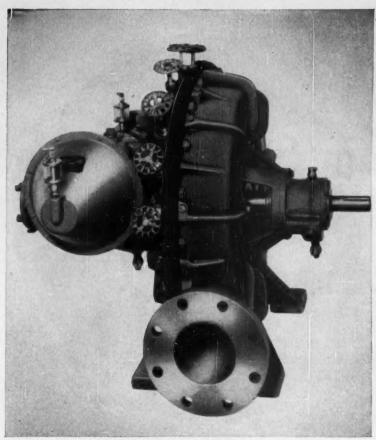
Insul-Mastic



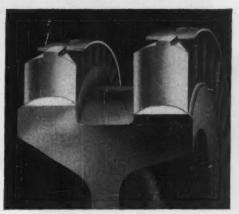
Think first of the coatings that last!

Representatives in Principal Cities

CORPORATION OF AMERICA . OLIVER BUILDING, PITTSBURGH 22, PA.



This is the reliable Coppus Turbine furnished with either type of wheel



Wide bucket "L" type wheel



Regular type wheel

Top performance in all COPPUS TURBINES

Both the regular type wheel or wide bucket "L" type wheel give you Coppus proven high quality and low maintenance cost. The "L" type wheel is the new development for use where low water rate is essential.

Coppus "Blue Ribbon Turbines" earned their fine reputation right on the job. Users vouch for their top quality performance and their low maintenance cost.

In the words of the supervisor of a large chemical company: "Coppus turbines require so little maintenance that a person would starve to death, if he depended on it for a living."

Proven features of all Coppus Turbines:

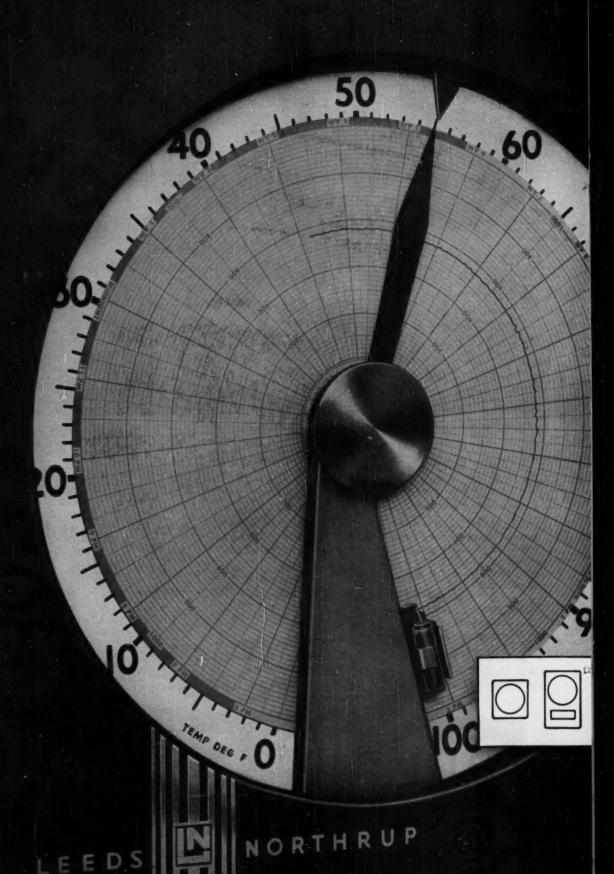
- Turbines rated close to your hp requirements, from 150 hp down to fractional. No need to buy a bigger, costlier turbine than your conditions call for.
- A larger number of steam nozzles, controlled individually by manually operated valves.
- Exclusive pilot operated excess speed

safety trip supplementing constant speed governor.

- Replaceable cartridge type bearing housings.
- Optional carbon ring packing glands.
 Coppus Steam Turbines ranging from 150 hp down to fractional, in 6 frame sizes, make turbine dollars go farther. Send for Bulletin 135 on Coppus Turbines.

COPPUS ENGINEERING CORPORATION
224 Park Avenue, Worcester 2, Mass.
Sales offices in THOMAS' REGISTER

COPPUS "BLUE TURBINES



Actual Size 11" x 12"



SPEEDOMAX'H

a new concept in instrumentation

Here's the new Speedomax H two-position recording controller. It is one of a complete line of electronic, null-balance potentiometer instruments that combines compactness with "big instrument" performance... outstanding simplicity of design with mechanical ruggedness. Speedomax H has design and construction features that result in multiple advantages unique in the field of industrial instrumentation.

Space-saver size—because of its efficient design. Its compactness permits substantial savings in panel space... two instruments can be mounted side by side in 24 inches.

Operating ease—is not sacrificed for size. Readability and "setability" of the Speedomax H illustrated are entirely comparable with that of conventional large size instruments.

Instrument adaptability—to a wide range of control problems. Available as an indicator, round or strip chart recorder, with any selected control integral to the instrument.

On-the-job economy—in initial cost, in ease of installation and during year-in year-out service. The outstanding design simplicity and mechanical ruggedness of all parts meet L&N quality standards for continuous, trouble-free performance.

Streamlined production—from the simplest indicator to the most complete standard controller. The instruments you want are delivered when you want them because they are assembled from ingeniously designed, in-stock components, producing savings in point-of-application cost to you.



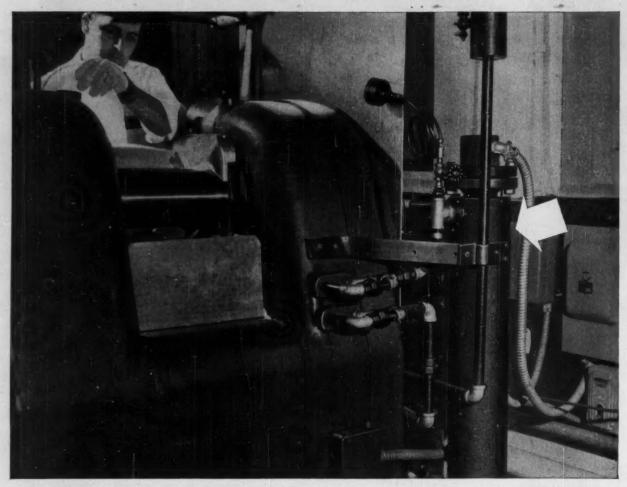
A complete line: Indicator, recorder, controller . . . round or strip chart . . . two-position or proportioning control. To see for yourself, the features of Speedomax H, get our pictorial fold-out which takes you inside the instrument. Just phone our nearest office or write us at 4916 Stenton Ave., Phila. 44, Pa. and ask for Die-Out ND46(1).











electrically heated oil eliminates high-pressure steam ...improves performance of plastic blending mill

To heat a plastic blending mill to temperatures ranging from 200 to 450°F was the problem faced by this manufacturer of extruded plastic films.

A steam system did not prove entirely adequate. For in order to supply the higher temperatures, it required high pressures. This put considerable strain on the expensive blending machine and other parts of the system. Losses in production time and material occurred while "waiting for pressure" during temperature changes.

Attaching a Chromalox Electric Oil Circulation Heater to the blending machine solved the problem . . . for electric heat generates high temperatures without high pressures. Heater inlet and outlet are attached directly to the steam lines. An oil circulating pump forces hot oil through the mill rolls. Installed capacity is 15,000 watts. Built-in automatic control measures out exact degree of heat to provide wide range of temperatures needed for fast, accurate blending.

Results are improved blending quality. Substantial increase in production. Considerable savings in raw materials. Reduction in maintenance.

This problem-solution-result approach has enabled us to help many manufacturers produce better, faster, at lower cost.

Always available to you are our research, engineering, design and modern manufacturing facilities. The world's largest factory stock of industrial electric heaters plus local stocks at strategic points. And a 33-city nationwide sales-engineering service.

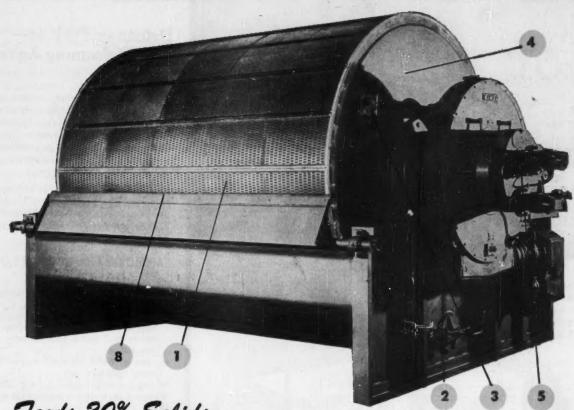
Let us know your problem for controlled heat and we'll go all out to help you find the right answer electrically.

EDWIN L. WIEGAND COMPANY

7514 Thomas Boulevard, Pittsburgh 8, Pa.



A-4437

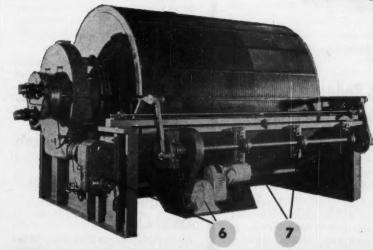


Feeds 20% Solids--Cake 89% Solids

This filter, a standard drum continuous vacuum filter design with most advanced features adapted for the customer's problem, incorporates such items as (1) rubber grids of thermo plastic type, (2) easy access through quick opening tank covers, (3) counterweighted pin type agitators, (4) steel drum-heads mastic coated, snap blow, rubber base plastic piping, (5) marine bronze valve and wear plate, (6) variable speed drives on drum and agitator, (7) antifriction bearings on agitator shaft.

In operation a dutch weave wire cloth is caulked in the grooves and the snap blow lifts the cake from the panel away from the drum surface so that the (8) rubber tipped blade never touches the drum.

All Eimco filters are engineered and designed with the idea of prolonging cover or bag life. Eimco engineers will consult with you in the selection of the correct media for best filtration and longest life and supply you with samples of Eimco media for your own laboratory work or will advise you on shipment of samples to Eimco Research Center for free filtration analysis.





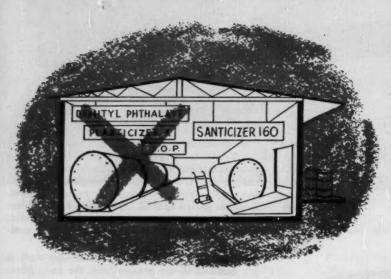
THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. Export Offices: Elmco Bldg., 52 South St., New York City

New York, N. Y. Chicago, III. San Francisco Calif. El Paso, Texas, A contrabam Ala, Duluth Man, Kallana Ida, Jandso Cur. San, San, Milan, Itali

You Can't Beat An Eimco

for your information...



Dibutyl Phthalate from Monsanto replaces several other space-consuming plasticizers.

How Production Men Can Reduce Costs By Reducing Inventory with Santicizer 160

If you are troubled by high storage costs and high inventory stocks, Santicizer* 160, one of Monsanto's quality plasticizers, may be just what you are looking for.

This versatile material is now being specified in numerous plants because it is the best general-purpose primary plasticizer now available for:

vinyl and nitrocellulose lacquers, polyvinyl acetate and polystyrene paints,

vinyl organosols and plastisols.

You will find Santicizer 160 can do

many of the jobs that formerly required such diverse products as DOP, DBP and similar materials.

And besides saving on inventory, Santicizer 160 has numerous other advantages, too. It has a wide range of compatibility, resists abrasion and extraction by various oils, gasoline and water.

Additional advantages include good heat and light stability plus lower volatility than DBP and only slightly higher volatility than DOP.

For information, send in the coupon today.

Defoamer PC-1244— New Defoaming Agent

Monsanto's new defoaming agent, Defoamer PC-1244, is particularly effective in systems where the continuous phase is organic in nature or in single-phase organic systems. The effective concentration varies from 5 to 5000 parts per million, depending on the system (average use concentration 250 ppm).

PC-1244 is soluble in many common solvents, shows excellent lasting qualities in systems with a pH below 7. It must be well mixed or dispersed for maximum efficiency.

APPROXIMATE PROPERTIES OF DEFOAMER PC-1244

Appearance of 100% materials: Straw-colored to yellow, viscous semisolid.

Soluble in: Benzene, toluene, kerosene, petroleum, ether, carbon tetrachloride, isopropanol, tertiary amyl alcohol, butyl cellosolve and ethyl acetate.

Insoluble in: Water, methanol, ethanol and methyl cellosolve.

PC-1244 is currently supplied as a 40% solution in kerosene and is available in commercial quantities

Tips on Handling Phthalic Anhydride Featured in New Book

Recommendations for in-plant handling of this versatile compound in either liquid (molten) or flake form are fully discussed, together with Monsanto's special phthalic anhydride shipping methods.

This booklet also describes uses of the product in the manufacture of alkyd and polyester resins, phthalate plasticizers, and in the production of dyes, pharmaceuticals and complex organic compounds.

Write Monsanto on your company letterhead for a copy.

Santolene J Reduces Sedimentation of Base Oils

In recent trials conducted by Monsanto, Santolene* J, a new addition agent, used at a concentration of 25 pounds per 1000 barrels of fuel oil, stabilized color—and reduced sedimentation of most base fuels.

For example: after 12 weeks' storage at 110° F., oil treated with Santolene J had an NPA color of D-5,

sediment measured 27 milligrams per liter. The untreated oil's color had darkened to D-6 and sediment per liter amounted to 103 milligrams.

Santolene J is not subject to depletion by water extraction, will not form fuel oil-water emulsions which create oil haze or foaming problems, and is not affected by ordinary storage temperatures.

Write to Monsanto for a technical bulletin which describes Santolene J and contains results of stability, sedimentation and rusting tests.



New Technical Bulletin on DDS Available

A technical bulletin has been prepared on dihydroxy diphenyl sulfone (DDS)—a chemical which promises to improve production of heat-resistant epoxy and phenolic resins.

Although primarily used as an agent in electroplating baths, DDS may also be useful as an intermediate in organic synthesis, particularly when a phenolic compound stable to the oxidating action of light and air would be valuable.

Several important DDS reactions, keyed to an extensive bibliography, are diagrammed in the bulletin. Write to Monsanto today for your copy.

Reinforced Plastics Fill Industry Need For Rugged Glazing

The recent growth of reinforced plastics in the consumer field has tended to obscure an equally important advance in the field of industrial applications.

Management of large industrial plants is turning more and more to reinforced plastic panels for sidelights and skylights.

Actual use in these applications shows that reinforced plastic panels have several advantages which make them outstanding for industrial application.

These panels are extremely strong and virtually shatterproof. They are lightweight, easy to assemble, completely translucent and require a minimum of maintenance. In addition, they are highly resistant to the effects of sun and weather.

Monsanto plays an important role in furnishing the raw materials for the resins which go into these reinforced plastics. It produces maleic and phthalic anhydrides, styrene monomer.

For more information on these products and their potentials in the reinforced plastic field, send in the coupon.

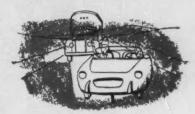


Ortho-Nitrochlorobenzene Chart Now Available

A large wall chart outlining the synthesis of over 120 compounds based on ONCB is now available from Monsanto.

Here on one page is a concise, ready reference showing the important chemical reactions of this versatile intermediate. Mail the coupon to get your copy.

New Multipurpose Additive Increases Lubricant Efficiency



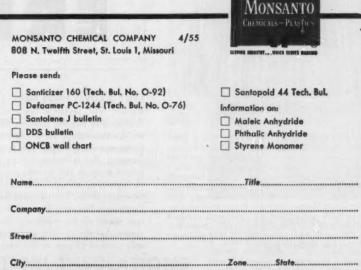
A true multipurpose additive which sets a new standard of gear lubricant performance has just been developed by Monsanto.

Called Santopoid* 44, the new additive combines in one product the best performance characteristics of several separate additives which are effective only in limited applications.

Lubricants compounded with Santopoid 44 provide complete passenger car hypoid protection under the most severe road test and laboratory conditions...not only in the SAE 90 grade but in the SAE 80 grade as well.

Field experience proves Santopeid 44 also gives better heavy-duty truck and bus gear protection without compromising superior high-speed performance. Heavy equipment is protected even when performing the most severe off-highway service.

For information, please mail coupon.
*Rog. U.S. Pat. Off.





AND HOLDING ON BY A MAGNET! There's quite a drop at the feet of this scaffold worker . . . but he is in no danger. He is holding on by a permanent-powered, reliable Eriez Magnet. This idea of permanent dependability is the reason why you find so many Eriez Magnets at work in industry today preventing fires, machinery damage and product contamination. All Eriez Magnets are non-electric, self-contained. They operate without any wires or attachments. Best of all their magnetic power lasts a lifetime. The first cost is the last.



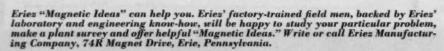
PULLEY CUTS CUSTOMER COMPLAINTS. At the Chicago Stock Yards Compost Co., "Fertilife" organic compost is produced. Bacterial processes speed up the composting period of the waste material (cow manure) and in four days the manure comes out as an odorless, weed-free compost. Previously, hinges, nails, even horseshoes managed to sneak into the bags of fertilizer. An Eriez Magnetic Pulley, recently installed at the end of the conveyor line that moves the dry material, now removes all traces of metal from the product. Customer complaints about tramp iron in the fertilizer have been completely eliminated.



THE GREAT GRATE MAGNET. It took a great design idea to provide magnetic protection for free-flowing material. With the Eriez Grate Magnet, baffle bars break the flow of material, direct the stream onto powerful magnetic tubes of stainless steel, so designed that the accumulation of tramp iron does not create choke-ups. The Eriez Grate Magnet prevents tramp iron damage to valuable equipment and prevents product contamination to free-flowing foods, chemicals, etc. Want more information on this product? ... request Bulletin B-204.

Magnetic ideas from ERIEZ

ERIEZ MAGNET FINDS FINES. Sheridan Products, Inc.; Racine, Wis., maker of firearms, ran into trouble when drilling gun barrels. Coolant oil, pumped through the drills, returns along the drill flutes, passes through a screen to remove metal chips, then flows to a reservoir for repumping. But microscopic fines drilled from the barrels passed through the screen, damaged the pumps. When the flow of oil slowed down, it formed a thick mass, broke expensive drills. The problem was solved when an Eriez Permanent Magnetic Ferrous Cleaner was installed in the line ahead of the reservoir. Now, as contaminated oil passes over the cleaner, all traces of metal are removed; only purified oil goes to the reservoir.







Tank Farm . . . ideas grow into insulation specifications at this unique testing unit

To study scientifically the effects of weather on insulations and protective finishes, Armstrong recently built a unique outdoor Tank Farm. Here, new and old insulation specifications and materials are evaluated under field operating conditions. Both high and low temperatures are held in a variety of pressurized, commercial and domestic oil tanks, and in a wide assortment of pipe lines.

The Tank Farm's equipment is extremely flexible so that insulation can be applied by one method and, if desired, replaced at any time to meet a completely different specification. Tests indicate which materials and methods warrant further development to replace current specifications.

This Tank Farm is but one example of how Armstrong Research is constantly working to improve industrial insulation materials and to develop simpler, more economical specifications. For full details on the Armstrong Line of industrial insulations and complete Contract Service, call your nearest Armstrong office or write Armstrong Cork Company, 206 Stratton St., Lancaster, Pennsylvania.



Study of new insulations, finishes, and methods of applying them is a continuous program of Armstrong Research. A new specification for applying corkboard is being made ready for testing on this experimental low-temperature tank.



The Fastest, Surest Coupling Known

KAMLOK quick couplers

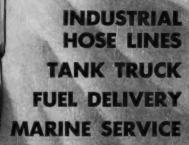
Make field repairs quickly with this simple attachment of hose to KAMLOK shank type adaptor and coupler by using hose clamps. Leakproof, light weight, easy to handle.

ALL KAMLOKS COUPLE AND UNCOUPLE INSTANTLY REGARDLESS OF HOOK-UP.



CORPORATION

2735 COLERAIN AVENUE CINCINNATI 25, OHIO



KAMLOK'S POSITIVE SEAL ALL ALONG THE LINE ASSURES GREATER SAFETY IN HANDLING ALL TYPES OF LIQUIDS.

Excellent hose has been condemned too often because of inferior couplings. To eliminate twisting, kinking, and straining, to add extra life and endurance to your hose use a good coupler...use KAMLOKS. Available in any combination to meet coupling requirements in sizes from 3/4" to 3" precision machined of special hard wear resistant bronze. 4" size of OPALUMIN.*

*OPW bi-tensile aluminum alloy.

FREE BULLETIN F-10 HIGHLIGHTS IN DETAIL KAMLOK'S QUICK, TIGHT SEAL









GIN. O.















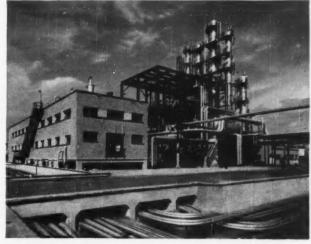
The new Condor catalytic cracking unit has a capacity of 15,000 barrels per day. The crude unit in the background has a capacity of approximately 45,000 barrels. Condor's new gas plant and compressor building are shown below.

Condor-AT RHO, NEAR MILAN

Located in the Po River Valley, and advantageously situated in relation to Italy's fine Autostrade highway system, "Condor S.p.A. L'Industria Petrolifera e Chimica," exemplifies the regeneration of Western Europe's essential industries.

The basic engineering for Condor's petroleum refinery process units was performed in the United States by Stone & Webster Engineering Corporation, with detailed engineering, procurement, and construction management by the Corporation's affiliate, E. B. Badger & Sons Limited.

Write or call us for information as to bow our experience may be of assistance to you.



STONE & WEBSTER ENGINEERING CORPORATION BADGER PROCESS DIVISION

AFFILIATED WITH E. B. BADGER & SONS LIMITED (LONDON)

New York

Boston

Chicago

Pittsburgh

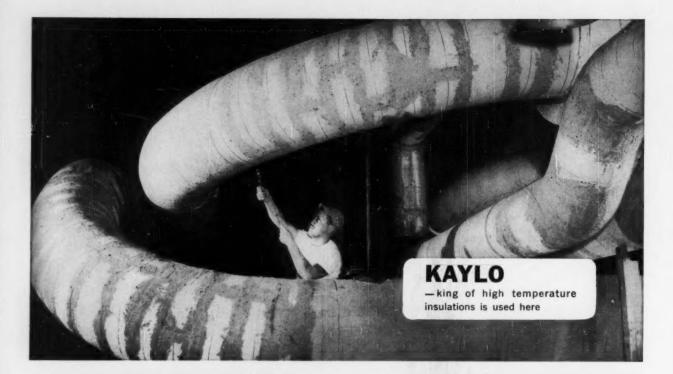
Houston

San Francisco

Los Angeles

Seattle

Toronto





THEY ANSWER ALL YOUR INSULATION NEEDS!

Kaylo_® and Fiberglas* are outstanding in thermal efficiency. They offer the most complete and versatile line of plant insulations available, ranging from lowest subzero to 1200° F. They are exceptionally strong—moisture-resistant—dimensionally stable—light in weight and easy to apply. They can even be used again after removal for pipe inspection! (Kaylo is now distributed by Owens-Corning and is available in quantity.) For full technical data about Kaylo and Fiberglas insulations

see Sweet's File, Chemical Engineering Catalog or Refinery Catalog. Or write: Owens-Corning Fiberglas Corporation, Dept. 97-D, Toledo 1, Ohio.



IN RESISTING GREAT PRESSURES

tightness tells

In the last quarter of a century Klinger Sleeve-Packed Cocks have steadily replaced the old-fashioned asbestos-packed cocks with their limitations of working pressure, difficulty of repacking, and tendency to jam. They are available in a wide range of designs and sizes for all purposes and pressures and with the following outstanding advantages:—

Renewable "Klingerit" Packing Sleeves.
Parallel-ground and non-jamming plug.
Can be re-tightened during operation.
Un-obstructed straight-thru full bore.

Write for the Klinger Master Catalog which describes the complete range of Klinger products, seatless piston valves, sleeve-packed cocks, reflex and transparent level indicators, natural, synthetic and silicone rubber and plastic products, and compressed asbestos sheet packing for every purpose.

WITH SLEEVE-PACKED COCKS

RICHARD KLINGER LIMITED, KLINGERIT WORKS, SIDCUP, KENT, ENGLAND

Cables: Klingerit

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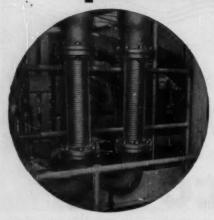
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C/5/55/6





Penflex Galvanized Steel Interlocked Tubing (8" I.D.), flanged at both ends. Installed as expansion joints on safety blow-off valves, they take up to 850 psi steam pressure at 900°F. Power plant applications like this one can't use less than Penflex Metal Tubing offers in flexibility, strength, and tightness. When safety valves go, expansion joints must hold. Penflex joints do. That's because they can give with the pressure and take it, too.

Thermal expansion at 900°F.... pressures up to 850 psi... impact and pipe movement under these strains—all are safely handled by Penflex. Forty-two complete units in this big power plant are protected from blow-outs by Penflex.

There are hundreds of other applications in the steam and diesel power fields for Penflex Interlocked Tubing and Penflexweld High-pressure Tubing. Call in the Penflex engineer to help you on your own particular problems. In the meantime, write for "Flexineering," your guide in buying and using Penflex Flexible Metal Tubing. There is no charge or obligation.

Pennsylvania Flexible Metallic Tubing Company, Inc., 7234 Powers Lane, Phila. 42, Pa.

Branch Sales Offices: Boston • New York • Chicago • Houston • Cleveland • Los Angeles
and Distributors in Principal Cities



Saves DOLLAR As It Solves Dust Problems!

Engineered simplicity of Type N ROTO-CLONE

assures highest efficiency lowest maintenance costs

Why does ROTO-CLONE cost less to maintain? Unique design of Type N achieves the ultimate in simplicity without sacrifice of efficiency. This wet-type collector circulates water without the aid of pumps and nozzles; features entrainment separators requiring little or no attention; has an interior face free of projections, ledges or restricted passages to accumulate collected material and, through re-use of water, cuts operating costs.

Why are space requirements less? ROTO-CLONE provides everything you need, except duct connections, in one complete shop-assembled package-collector, exhauster, motor, drive and dust storage hopper. This compactness makes its relocation easy and economical with change in process, plant layout or production equipment.

Why is performance outstanding? The high cleaning efficiency of this hydro-static precipitator results from the combined action of centrifugal force and through intermixing of water and dust-laden air. Such difficult materials as magnesium dust, buffing dust, lead oxide, lime and abrasive dust are routine assignments for the Type N ROTO-CLONE. What's more, the Type N's compensating water level feature permits maintaining this high cleaning efficiency over a wide range of exhaust volumes. And, with material collected as a sludge or slurry, there's never a secondary dust problem in disposing of the collected material.

Type N Precipitators are available in exhaust volumes up to 50,000 cfm. For complete information, call your local AAF representative, or write direct for Bulletin 277.

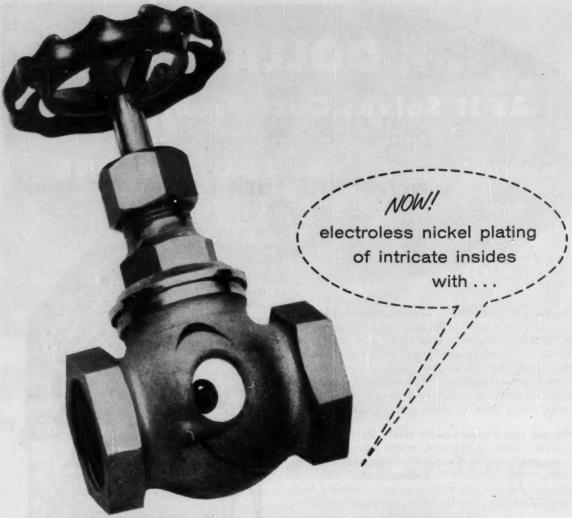


Type N ROTO-CLONE Arrangement D designed for continuous sluicing of sludge. Other arrangements are available for either manual removal or continuous disposal of the sludge.



COMPANY, INC.

326 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.



PFIZER SODIUM CITRATE

as your sequestering and buffering agent

Complex-shaped interiors, found in many valves and pipes, frequently are beyond the throwing power of an electroplating bath. Such equipment can be successfully plated without electricity by electroless nickel plating using Pfizer Sodium Citrate. This ideal buffering agent produces brighter plate in the alkaline bath and as a sequesterant prevents wasteful precipitation of basic nickel salts.

Other Pfizer chemicals of interest to metal finishers include: citric, tartaric, gluconic and oxalic acids, and their salts. Get the full details on how they help you do a superior job of cleaning, polishing and plating.

Please send me the items checked:	NAME
☐ Technical Bulletin 68, "Electroless Nickel"	POSITION
Technical Bulletin 61, "Chemicals for Metal	ADDRESS
Finishing"	CITYZONESTATE_

Manufacturing Chemists for Over 100 Years



CHAS. PFIZER & CO., INC.

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DARCO DEPARTMENT - ATLAS POWDER COMPANY
Darco General Sales Offices—60 EAST 42nd STREET, NEW YORK 17, N.Y.
ATLAS POWDER COMPANY, CANADA, LTD., BRANTFORD, CANADA

How to use activated carbon economically



By means of a Darcograph, you can plot the relation between color adsorption and carbon dosage ... and read off the dosage for the residual color you require. We'll be glad to send you a Darcograph, complete with instructions on how to use it. "Look before you leap" is good advice anywhere. And it applies to the use of activated carbon for removing impurities. In this instance, the motto translates liberally to "find out what you want to adsorb before you try to adsorb it."

It's hard to judge by eye, for example, how much color there is in a liquid... and whether it can be removed by a reasonable amount of activated carbon. Colors are deceptive. A relatively light color may be caused by an unexpectedly large amount of pale color-causing compound. In this event, an unexpectedly large amount of carbon would be required to do the purifying job.

The quick and sure way to tell what you're up against is to run an adsorption isotherm. It takes only a modest amount of laboratory time... and by using the DARCO-GRAPH, you'll be able to determine just what carbon dosage will be required to get the decolorizing effect you want.

Maybe the answer will be that you need dosages of 15 to 20% of carbon. What do you do then—abandon the idea of using carbon?

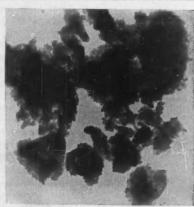
Not at all. Call on us, and tell us about your problem. Usually we know some way to solve it . . . by using some trick for preliminary purification, counter-current use of carbon, or the divided treatment technique. We're specialists—don't hesitate to call on us for ways to use carbon most economically.

Darco has high adsorptive capacity

In the manufacture of Darco activated carbon, the "activating" process gives a tremendous area to the carbon particles. By actual laboratory test, it has been found that one cubic centimeter of Darco may have an effective adsorptive surface of one ucre.

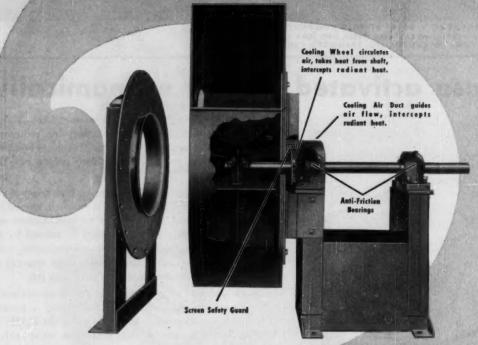
Some of this area is on the outside of the individual carbon particles. Most of it, however, represents the area of the internal pore structure produced by activation. This structure can be seen in the picture at the right . . . an electron microscope photograph of a Darco particle. Being a carbon designed for use in liquids, Darco has pore openings big enough to admit relatively large molecules such as are likely to be responsible for color, odor, haze or foam.

A number of different grades of Darco are available with varying particle size and adsorptive capacity for various applications. We'll be glad to help you select the grade that best meets the



economic and adsorptive requirements of your particular problem. Send us full details about your specific solution, impurity level and process conditions.

WANT TROUBLE-FREE high temperature air handling?



New Clarage Type XI. Fan shown in "opened up" view is typical of the sizes which provide universal discharge.

MONEY-SAVING SOLUTION:

Clarage's new Type XL Fans equipped with AIR Cooled Bearings!

FOR TEMPERATURES UP TO 750° F., here's a simple, dependable, inexpensive feature available on standard Clarage fans. Costlier water cooled bearings NOT required. By all means, on your next "hot" job consult the Clarage sales engineer about this money-saving optional feature.

The new Clarage Type XL Fan — with its advanced design — offers many other important advantages in industrial air and material handling.

Learn about the high efficiency, rugged construction, and in-the-field adaptability of this exceptional fan equipment by requesting Bulletin 702. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

NOTE: For heavier-duty service or temperatures above 750° F., this and other types of Clarage fans can be provided with water cooled bearings.



Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES . IN CANADA: Conodo Fons, tid., 4285 Richelleu St., Montreal

Relamp or Convert to Higher Wattages in SECONDS... APPLETON Applied For ventej Explosion-Proof

APPLETON INTERCHANGEABLE UNILET BODY FEATURE





Fixtures

Note how identical diameters "A" at top of Dome Unit Assembly permit mounting of all fixtures regardless of wattage.

SECOND RELAMPING



When the call comes for re-lamping, AA-51 Series STAND-BY Units are ready at an instant's notice. Carrying handles can be attached in



Maintenance man needs only a screw driver to exchange units. From the time of climbing the ladder to ex-changing fixture and des-cending ladder, only 58 sec-onds are required.



ing fixture are safely at-tended to at the work bench, while production schedules are maintained.

Standardized Unilet Body Permits 58 Second Interchange of 60 Watt to 500 Watt Fixtures . . . Saves Time, Prevents Shutdowns! Appleton AA-51 Series Vented Explosion-Proof Fixtures offer the most complete spark-caused disaster protection available today . . . plus the shortest possible lamp exchange time with no loss of man-hours and no lengthy machinery shutdowns.

The AA-51 Series meets all Underwriters' Laboratories requirements for Class I, Groups C and D Hazardous Locations.

More and more plants in all industries where hazardous locations are present, are standardizing on Appleton for maximum, efficient protection.

Full details are available. Write Today for Bulletin!

- . "FLAME-TIGHT" CONTACT CHAMBER
 - Because of Appleton's exclusive "5-Thread Safety Chamber" any AA-51 Series Unit can be serviced with complete safety even if current is inadvertently left on!
- "FULL-CIRCLE" VENTING
 - The notched globe ring and the porous metal interior dissi-pate heat evenly and safely and keep fixture temperature cool enough to prevent igniting explosive gases. "STAND-BY" SYSTEM SAVES MONEY
- - For every ten AA-51 Units in operation Appleton recom-mends one unit as a stand-by . . . ready for relamping or wattage conversion in 58 seconds.

Sold Exclusively Through Selected Wholesalers

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Also Manufacturers of:













caustic soda-

which strength should you buy?

Here are the facts to help you decide which saves you more—50% or 73%

Can you save by switching from 50 to 73% liquid caustic? Your answer will depend on:

- 1. Your caustic soda freight rate.
- 2. Your facilities for handling caustic.
- 3. The amount of caustic you use.

Advantages of 73% liquid

- With 73%, there is a substantial saving in freight charges. 63% less water is shipped per unit weight of dry caustic soda.
- 2. You will place fewer orders. This cuts down on your billing work.

Disadvantages of 73% liquid

- It is priced \$2.00 more per ton (dry basis) than 50% because of higher manufacturing costs.
- If you store it as 73% liquid, you will need heated, nickel-clad steel storage tanks.
- If you dilute 73% to 50% while unloading, you will need a cooler and other equipment. This represents a considerable investment which can be reduced if you have

suitable equipment already on hand.

Use this table to see if you can save with 73%

Use the table at right to find your approximate saving on freight charges with 73% liquid caustic. The table balances two cost factors . . . lower freight charges and the higher initial price of 73% liquid caustic.

To estimate your yearly savings, multiply the figure in the right-hand column which applies to you by your annual consumption in tons (dry basis).

From these savings you will have to deduct the cost of equipment for diluting to 50% while unloading.

Freight rate per hundred weight in cents (including taxes)	Net savings per ton (dry basis) in dollars
5	minus 1.40
10	minus .80
15	minus .10
16	0
20	.60
25	1.20
30	1.80
35	2.40
40	3.00
45	3.70

HERE'S HELP-WITHOUT COST

You gain much by choosing the right strength for your conditions. In coming to a decision, why not give yourself the advantage of unbiased expert technical help? A call to your nearest Hooker sales office puts at your disposal, without obligation, the experience gained in 50 years of supplying caustic soda to industry.

Your Hooker technical service man can show you what equipment you need for converting, and help you figure your exact savings. Why not phone or write him today at the nearest Hooker office?

"CAUSTIC SODA BUYER'S GUIDE" is the title of a new pocket-size booklet we will be glad to send you. Contains helpful facts on the economics of 50% and 73% solutions; other forms of caustic soda; capacities of tank cars and other containers; useful shipping information. Write for a copy.

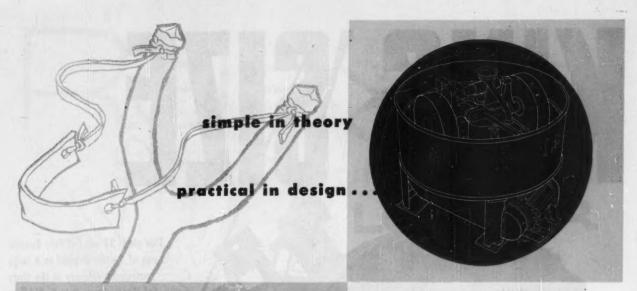


1905—Half a Century of Chemicals
From the Salt of the Earth—1955

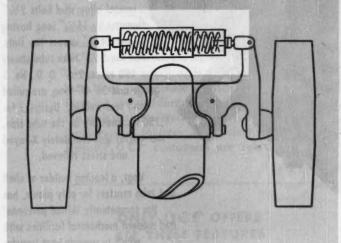
HOOKER ELECTROCHEMICAL COMPANY

5 FORTY-SEVENTH ST., NIAGARA FALLS, N. Y.

NIAGARA FALLS . TACOMA . MONTAGUE, MICH. . NEW YORK . CHICAGO . LOS ANGELES



... LOADED FOR ACTION



A new 12 page bulletin providing complete specifications, capacity requirements and industries served by Simpson Mix-Mullers is available on request.



New spring loading technique provides positive control during mixing

The best apportioned mixes oft go astray between scale and use.

If you mix, and have found that proper formulation, expensive ingredients and careful weighing don't always add up to a uniform batch—you realize too, the need for controlled mixing.

With the new F Series Simpson Mix-Muller we've added a new dimension to mulling. With it, full time control over mulling pressure is now practical—and simple. Here's how it works:

The muller wheels are suspended to receive pressure through a spring load. Mulling pressures ranging from 1600 to 4000 lbs.* can be brought into action at the turn of a wrench. And what's more, presettings are possible that will increase effective muller pressures as needed, or as the mix builds in strength during the mixing cycle. If your mix is dry, but not a powder . . . wet but not a fluid, it will pay you to find out more about the new Simpson Mix-Muller. Working for you on an hour by hour and day by day basis, controlled mulling can ring up a real savings in more efficient use of all mixture components—declare a dividend in

can ring up a real savings in more efficient use of all mixture components—declare a dividend in product quality and uniformity. Write for details on a laboratory test on your material, or for our new bulletin on Simpson mulling and remember . . . MIXING IS OUR BUSINESS—our principal business since 1914.

* (on the 60 cu. ft. Mix-Muller)



NATIONAL ENGINEERING CO., 636 Machinery Hall Bldg., Chicago 6, III.



MING SIZE



This giant 37 ton Cat Poly Reactor is one of 4 units shipped to a large petroleum refinery in the State of Washington. It is 4'-31/2" in diameter by 32'-0" long and has a 13/16" thick shell. Each of its 8" thick heads is attached to the shell channel with 28 special alloy stud bolts 23/4" diameter by 151/4" long having nuts 41/4" across the flats. Into the 53/4" thick tube sheets 190 tubes, 21/2" O. D., No. 5 gauge and 30'-0" long, are rolled and seal welded. Designed for 1,230 lbs, pressure on the tube side, the reactor was completely X-rayed and stress relieved.

Vogt, a leading builder of shell
and tube reactors for poly plants, has
the competently skilled personnel
and modern mechanical facilities with
which to provide heat transfer
equipment for the most exacting
services in petroleum refineries,
chemical plants, and related
industries.

Reactors ...by Vogt



A bulletin describing the wide range of heat transfer equipment built by Vogt is available upon request.

HENRY VOGT MACHINE CO., LOUISVILLE, KENTUCKY

BRANCH OFFICES: NEW YORK, CHICAGO CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA

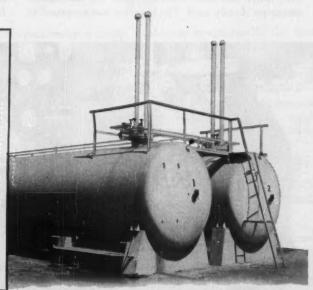
First to recognize storage tanks need to be stress-free, too ... QCf pioneered in STRESS RELIEVING after complete fabrication. Every QCf Tank... from the 30,000 gallon capacity down to the small ones...are heated in a huge oven to eliminate stresses set up during forming and welding. This process provides the tank with resistance to fatigue caused by temperature changes and pulsating loads. Result? QCf customers are relaxed, too

... because they know their tanks are SAFER and LAST LONGER.

QCf Tanks are available for LP gas, anhydrous ammonia, and other gases or liquids under pressure. For more specific details, write or call: Dept. 4-C, QCf Industries, Incorporated, Industrial Products Division, 30 Church Street, New York 8, New York.

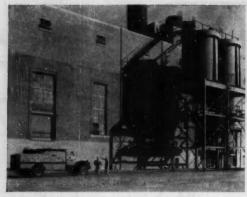
ONLY QCf OFFERS **ALL THESE FEATURES**

- Complete Radiography of every welded seam assures freedom from slag inclusions, porosity and undercutting.
- Hartford Steam Boiler Inspection in accordance with ASME 1952 Code W-XR-SR.
- Steel Grit-Blasting of tank exteriors to remove mill scale, resulting in a smooth surface for red lead primer.
- Large Diameter Design in all tank sizes require 30% less installation space and permit single-car shipment...cuts down weight for more economical rigging and handling.
- Manway for thorough internal inspection and cleaning.
- Steel Saddles and Supports for installation on flat foundations are optional.



QCf STORAGE TANKS - SAFETY VALVES

300,000 PPH BOILER CLEANED CHEMICALLY IN ONE DAY!



Dowell engineers bring solvents to the job in truckmounted tanks, along with all pumping and control equipment. They apply the chemicals as necessary by filling, spraying, jetting, cascading or vaporizing.

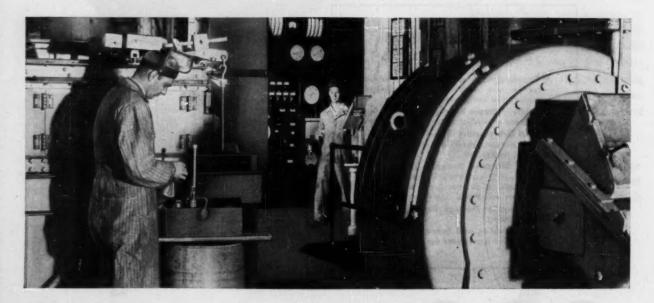
Comparative cases showed DOWELL cleaning took less time... removed more scale than mechanical methods

This is a case history on a 300,000 pound per hour boiler in a refinery. A routine inspection showed that iron oxide and silicate scale fouled the tubes. Dowell engineers cleaned the boiler with chemical solvents in less than 22 hours.

Dowell chemical cleaning is the standard method of removing deposits from boilers in this plant. Comparative tests showed that the chemical method was both faster and more thorough than the mechanical means previously used. The operator was surprised at the relatively large amounts of scale and sludge removed by chemical cleaning. Dowell has cleaned 25 of the 27 boilers in this plant. Several have been cleaned as many as three times on an annual basis.

Dowell liquid solvents go wherever steam and water flow, reaching surfaces inaccessible to other methods. No special scaffolding is required. Dismantling and down-time are kept to a minimum. Often, equipment may be cleaned while in operation.

Perhaps chemical cleaning could improve the efficiency of equipment in your plant—for example, heat exchangers, piping systems, tanks and process towers. For complete information and estimates, call the nearest of more than 130 Dowell offices, or write directly to Dept. D-33 DOWELL INCORPORATED, TULSA 1, OKLAHOMA.



chemical cleaning service for industry



A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

April 1955—CHEMICAL ENGINEERING

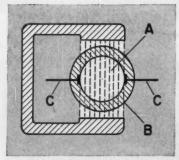
NEW! a flow meter with no flow restrictions!



- Adds no pressure drop nothing inside pipe to interfere with fluid flow.
- Measures fluid velocity directly.
 Overall accuracy better than
- 1% of range over entire scale.

 Output Uniform flow scale.
- ©Full accuracy sustained even on liquids other meters can't handle: viscous, corrosive, or pulpy even sand-water slurries.
- Easy range change either by Multi-Point Switch or range coil replacement, as preferred.
 2" to 8" sizes standard — larger sizes as required.

FOXBORO MAGNETIC FLOW METER



SIMPLE, TROUBLEFREE, OPERATION

The Foxboro Magnetic Flow Meter operates on the same principle as a power generator. A magnetic field (A) is maintained through a standard pipe section (B) of stainless steel or other non-magnetic material. This pipe section is lined with Kel-F® or other insulating material. Liquid passing through pipe acts as moving conductor, generating an electric voltage which varies in proportion to liquid's average velocity. Flush electrodes (C) in pipe wall "pick up" this voltage which is recorded in desired flow units by Dynalog Electronic Recorder or Controller.

This premium-performance meter measures magnetically the flow rate of virtually any liquid except hydrocarbons. It completely ignores such common metering headaches as turbulence, suspended solids, and variations in conductivity, density, and viscosity. It even measures reversing flows.

Installation is simple. The magnetic spool piece connects into the line like any equivalent length of pipe — no seals, purges, meter runs, or straightening vanes required. Connects by 2-conductor cable to remote Dynalog Electronic Flow Recorder.

Maintenance is practically eliminated. There are no pressure taps to become plugged or frozen, no working parts to foul.

Foxboro Magnetic Flow Meters are already in use on such widely different liquids as beer, sand-and-water, rosin size, rock-and-acid slurry, viscose, and highly corrosive liquid detergent. Find out how this precise, troublefree flow meter can help your processing. Write for complete details.

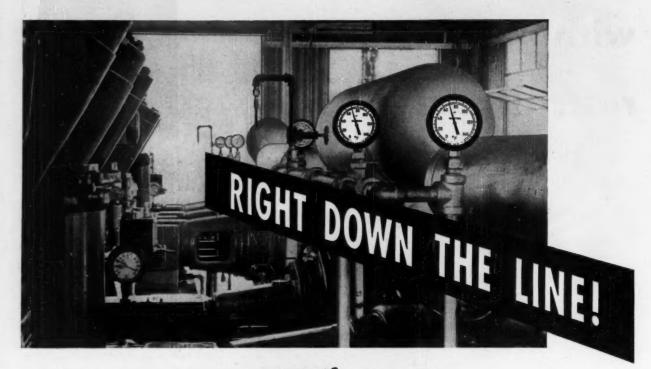
THE FOXBORO COMPANY, 364 NEPONSET AVENUE, FOXBORO, MASS., U.S.A.



Foremost in FLOW METERING

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

DEPENDABILITY



Weston thermometers with Multiple bimetal helix

The reasons why WESTON all-metal industrial thermometers excel in dependability and long life...enjoy such outstanding preference throughout industry...stem in large part from Weston's exclusive design and manufacturing methods. The critical sensing elements are all Weston-made in the shorter multiple helix form to insure rugged, nonsagging units. They are then cycle-seasoned, over broad temperature ranges, to insure consistently precise indications over far longer periods. Thus they serve better, longer, at far lower over-all costs. Bulletin containing sizes, ranges and prices, available on request. WESTON Electrical Instrument Corporation, 614 Frelinghuysen Ave., Newark 5, N.J.



Thermometers

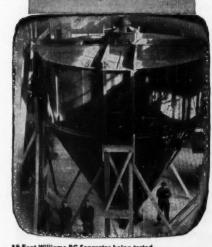
AVAILABLE THROUGH LEADING DISTRIBUTORS



More Accurate Sizing Of Ground And Pulverized Materials!

ENGINEERED FOR PRECISION CONTROL AND HIGH PRODUCTION

Material to be classified is 7ed into the top of the machine and drops onto a revolving distributing plate. This distributor is so designed that it sprays the material into a rising air current which entirely surrounds the plate. The finer particles are lifted by the air stream and the coarse particles drop down to the rejects spout. Passing up through the separating chamber, the dustiaden air is given a whirling motion between Spinner blades and any remaining oversize particles are precipitated. The separator is adjustable to control the fineness of the finished product with unusual accuracy.



18-Foot Williams RC Separator being tested at plant before shipment.

WILLIAMS MECHANICAL AIR SEPARATORS For Finenesses From 30 to 325 Mesh

 Most efficient mechanical air separator ever developed for classifying ground and pulverized materials, or for removing fines from dry ground materials before classifying.

 Product quality is vastly improved and output considerably increased when operated in closed circuit with virtually any type of mill.

 Will handle with equal efficiency a complete range of products—mineral, chemical and vegetable—from the hardest, most dense limestone and ore to the softest, fluffiest starches and flours.

 Permits coarser settings in grinding equipment thus lengthening equipment life by reducing wear on all moving parts. Power consumption is much lower.

Extra heavy construction. Equipped with anti-friction bearings encased in dust-proof and moisture-proof housings. All casings are of heavy steel plate construction. Operation is dustless and repair cost is practically nii, since there are no fine sieves to wear out and the heavy construction insures long life.

9 Standard sizes, 21/2 to 18-foot diameters - Capacities from 500 lbs. to 75 tons hourly

Write For Details And Describe Your Operation

WILLIAMS PATENT CRUSHER & PULVERIZER CO.

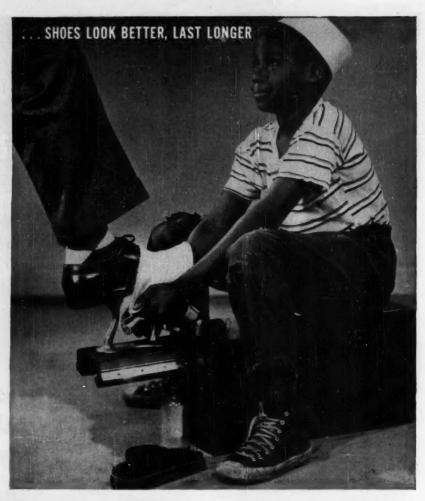
2706 NORTH NINTH . ST. LOUIS 6, MO.

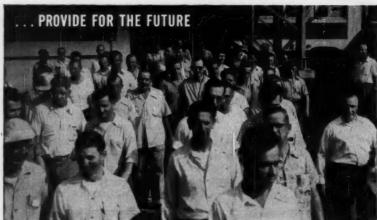


OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD

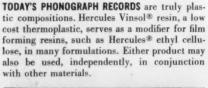
HOW HERCULES HELPS...

"CHEMICAL COBBLERS"—Hercules materials help the shoe industry in many ways in their annual manufacture of more than 500,000,000 pairs of shoes. Hercules® nitrocellulose, ethyl cellulose, and resins go into adhesives, coatings, and stiffening compounds. Other Hercules products improve the processing of insoles, soles, and heels, give bulk and shine to polishes, help treat leather, appear in molded plastic heels, and in box toes, laces, and tips.





A CAREER MORE THAN A JOB is the philosophy behind Hercules' personnel policies. To assist employees in their efforts to attain security for themselves and their families, Hercules' personnel program includes a liberal vacation plan, a disability benefit plan, accident and sickness insurance, a hospital-surgical plan, group life insurance, and other benefits. A comprehensive personnel program is only one of several good reasons why many turn to Hercules for positions with a future.







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SYNTHETIC RESINS, CELLULOSE PRODUCTS, CHEMICAL COTTON, TERPENE CHEMICALS, ROSIN AND ROSIN DERIVATIVES, CHLORINATED PRODUCTS, EXPLOSIVES, AND OTHER CHEMICAL PROCESSING MATERIALS



CHEMICAL MATERIALS FOR INDUSTRY

April 1955—CHEMICAL ENGINEERING

what's the **ONE BEST**

answer to your problem of...

... GRANULATING?

A rotary knife cutter is probably your one best answer to granulating problems. It usually produces particles of more uniform size than are obtainable through any other type of machine. On the other hand, Sprout-Waldron has sometimes used roller mills with proper combinations of roll corrugations and speed differentials for this task. The attrition mill often offers the most flexible and economical means of granulating because disc surface, speed of rotation, clearance between surfaces, and feed rate can be varied. And a crusher might be the answer if the material is somewhat friable and the end-product

The nature of the material and the end product desired determine the proper machine to use with the least possible cost. Perhaps in no other operation is experience so important. The control of particle size in a finished ground product and the holding of extreme fines to a minimum are fields in which Sprout-Waldron has had unlimited experience.

... DEFIBERIZING?

Pulling rags apart into threads or ragged swatches, flocking sheet pulp, pulping wood chips, shredding leather, defiberizing old rubber tires, shredding jute-to name only a few widely scattered operations that can be classified as involving a defiberizing action-are applications on which Sprout-Waldron engineers and Sprout-Waldron products can combine to give you the one best answer. Each case must be investigated as to material and end results desired. And from such an investigation will come a recommendation that very conceivably can put you far ahead of your competition.

.. PULVERIZING?

For many operations classified as pulverizing, Sprout-Waldron can supply the one best answer from a vast line of size reduction equipment. And if Sprout-Waldron doesn't have your one best answer, you'll be told who does have it.

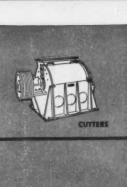
For some pulverizing, hammer mills are often the answer, and Sprout-Waldron has an interesting and unique line of units that have solved many different processing problems by proper selection of hammers and screens. Many times attrition mills or roller mills furnish the *one best* answer, and where a fine, floury texture is particularly important, burr stone mills can sometimes be the solution.

Each size reduction problem has a solution that is the one best answer and that can be determined by submitting the problem to Sprout-Waldron. You will receive a recommendation based on the combined experience of men working constantly with size reduction problems and backed by successful case history files of processing solutions, and laboratory processing test data. If Sprout-Waldron equipment does not meet your needs, you'll be directed to a manufacturer who can supply the one best answer. Let Sprout-Waldron study your size reduction problems without cost or obligation.

SPROUT-WALDRON Manufacturing Engineers Since 1866

Equipment for SIZE REDUCTION - MIXING & BLENDING - PELLETING & CUBING - BULK MATERIALS HANDLING - PRODUCT CLASSIFICATION

Facilities for fabricating, machining, custom founding, woodworking, laboratory testing 15 LOGAN STREET . MUNCY, PA.









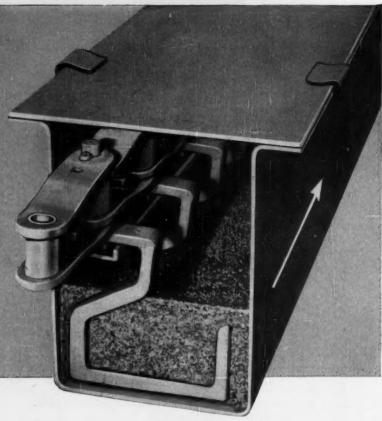




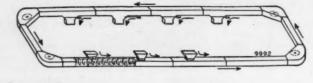


CONVEYS ANYTHING Economically from COAL to CORNSTARCH

with simultaneous pick-up or discharge at one or many points...without dust or contamination...in



This is an S-A REDLER Horizontal Closed Circuit Conveyor — and a very remarkable unit it is!



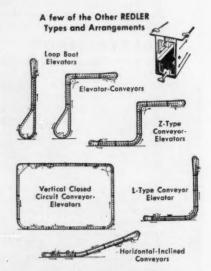
It conveys in four directions — can pick up and discharge at many points on its run simultaneously or selectively—does the work of several conveyors of other types. It is fully enclosed — dust-tight and contamination-proof. Because it moves materials in mass, in a solid column, it minimizes dust formation and degradation and practically eliminates explosion hazards.

It is self-feeding and can be choke fed without jamming. Any excess material simply recirculates until needed. The REDLER is also selfcleaning, an important advantage when the operation calls for running various materials in sequence. It makes an ideal blending conveyor.

Unusually compact, REDLERS require a minimum of structural support. They can be easily and economically adapted to practically any plant layout.

The closed circuit REDLER is just one of many types furnished by S-A. If you handle or work with any kind of granular, pulverized, flaky or small lump material, a REDLER can help you do it better, cleaner and at lower cost.

Write for Catalog No. 140. We'll be glad to give you a preliminary cost estimate. No obligation, of course.





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A complete line of industrial ball bearing units available in both standard and special housings.

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controlled Evaporation —available in a wide range of evaporation rates with precise characteristics to meet your most exacting requirements.

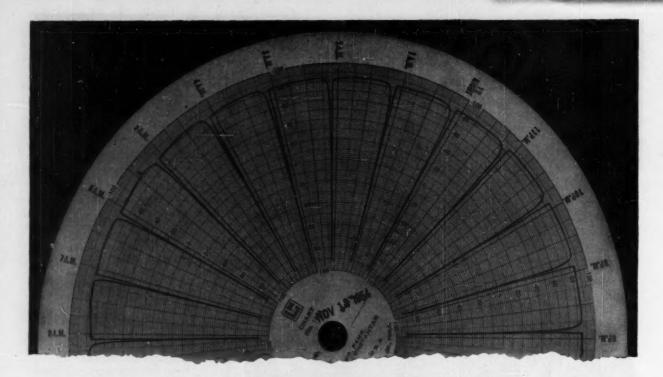
FOR TECHNICAL ASSISTANCE — If you have a solvents problem or want further information on the specifications and characteristics of Esso Solvents—write or call our office nearest you. Our technicians will be glad to assist you.

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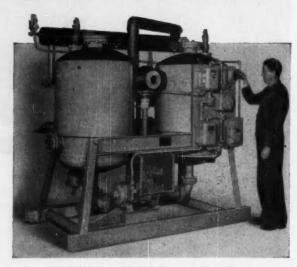
A Lectrodryer's DRYing day is 24 hours long-year after year

A Lectrodryer* is DRYing hydrogen as shown by the chart reproduced in part above. (The periodic boosts in temperature are to defrost the mirror of the dewpoint recorder). The entire DRYing operation proceeds automatically day after day.

DRYing air, gases and organic liquids has long been routine for Lectrodryers—the first went to work on natural gas over twenty-two years ago. Today Lectrodryers are installed all over the world, safeguarding materials in storage and in process, or holding delicate chemical reactions on the straight-and-narrow path. Some are tiny and others are huge, but all are efficient, dependable DRYing tools.

If unwanted moisture is giving you trouble in any phase of your operations, ask a Lectrodryer engineer to suggest a solution.

There's probably a standard Lectrodryer capable of handling the job. The book, Because Moisture Isn't Pink, tells you how others are using them. For a free copy, write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.



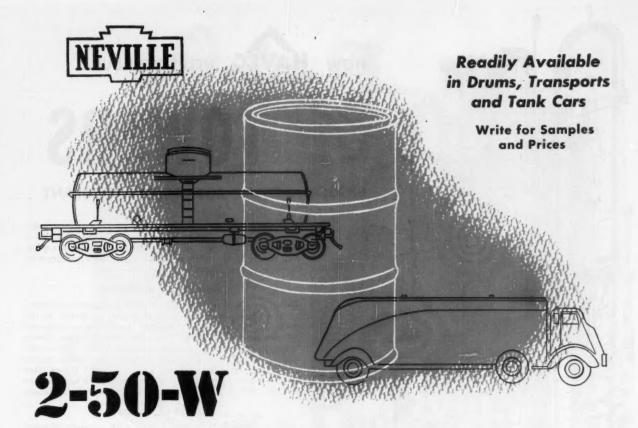
DRYing with this Type BY Lectrodryer can be done automatically and continuously, year after year.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham. In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.

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LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS

LECTRODRYER



Hi-Flash Solvent

If you manufacture Alkyd Finishes, Aluminum Paints, Marine Finishes, Varnishes, Enamels, Cements, Adhesives . . . it will pay you to test 2-50-W Hi-Flash Solvent.

This Neville Solvent offers you:

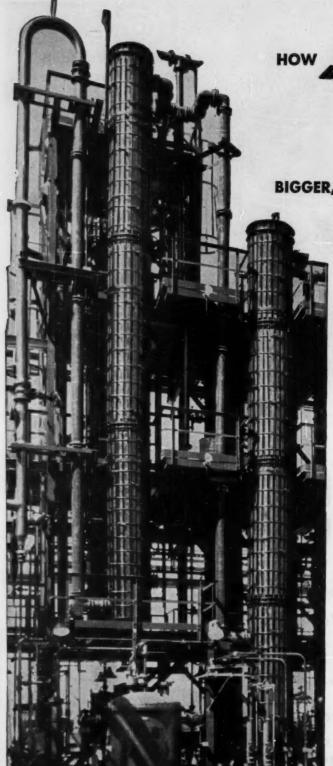
- . HIGH FLASH POINT
- GOOD ODOR
- . HIGH SOLVENCY POWER . COAL TAR ORIGIN
 - . SLOW, EVEN EVAPORATION RATE
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NEVILLE CHEMICAL CO.
PITTSBURGH 25, PA.

Plants at Neville Island, Pa., and Anaheim, Cal.

Typical Properties

Specific Gravity
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50%170°C.
95%185°C.
End Point (Dry)191°C.
Flash Point, T.C.C105°F.
Color, Saybolt+26
Acid Wash Color8
Corrosion
Kauri-Butanol Value90
Aniline Point (Mixed)24°C.



HOW HAVEG HELPS YOU BUILD

TOWERS

BIGGER, BETTER, CORROSION-RESISTANT

This was a big, exacting job for an old Haveg customer, and a good example of Haveg's usefulness as a material and a process equipment manufacturer. The project engineers specified towers of Haveg to eliminate their major problems in the fight against corrosion.

FIRST, WHAT IS HAVEG?

Haveg is a plastic material sold in finished process equipment, or as a cement for construction of plastic equipment in the field. It is not paint or a coating. Made from acid-digested asbestos bonded with special corrosion-resistant resins, Haveg is usually molded and cured into its finished forms: Cylindrical and rectangular tanks and towers, pipe and fittings, valves and pumps, fume duct systems, heat exchangers. Haveg takes high sustained temperatures (over 265°F. with a wide margin of safety). It resists thermal shock, seldom requires insulation.

HAVEG CAN BE BIG

Because Haveg is a molded plastic with adequate physical strength for self-supporting equipment, large equipment can be made. Diameters from ½ inch to a maximum of 10 feet can be built up in sections. The towers illustrated were assembled three and four high, with standard metal flanged connections. Metal inserts for connecting studs can be embedded in Haveg at the time of molding. However, most pipe connections are molded into the wall ready to take any standard pipe.

HAVEG WIDENS YOUR DESIGN RANGE

If you were to make a model of your next tower installation you would mold in many desirable features not usually possible with standard construction materials: More outlets, improved trays and distributors. When you build with Haveg all this becomes possible and practical. Haveg is inexpensively and rapidly molded into the design, shape, form you need to do a better chemical handling job. Openings, special bottoms are built into your tower sections by skilled plastics molders. Should your plans or processes change, Haveg can be machined and altered by you, on the job. Accidental mechanical damage is easily repaired, using Haveg cement and maintaining full chemical resistance.

KNOW THE FULL STORY

Haveg has a proven service record in the toughest chemical services, resisting most acids, salts, chlorine, many solvents. There's much more to tell about Haveg and the way it can help you. A 64-page illustrated Bulletin F-6 is yours for the asking. Contains size and chemical resistance charts, design specifications. Write today. Also, talk to the Haveg sales engineer whose office and phone is listed. Remember, Haveg is a logical answer to your design problem in towers; in fact, on all process equipment that touches corrosives.

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HOUSTON 4, Jackson 6840

SEATTLE 7, Hemlock 1351

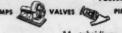
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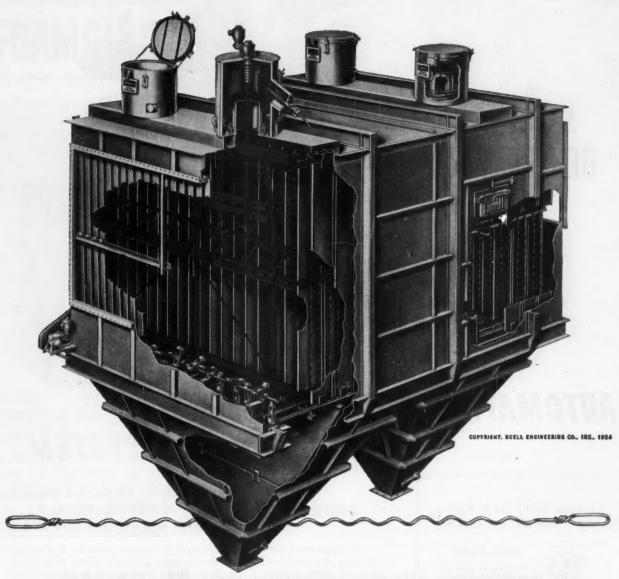
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*A subsidiary of Continental-Diamond Fibre Co



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We'll be glad to give you the name of one near you, so you can see for yourself how Buell 'SF' Electric

Precipitators recover as much as 40 tons daily... how they often provide a handsome cash return.

Take a good long look at such exclusive features as the Buell 'Spiralectrode' which is unequalled for effective dust precipitation.

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Semi-automatic, continuous-duty Selas Dehydrator; capacity 14,500 scfm air at 150 psig.

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Other SELAS UNITS FOR AIR-GAS PROCESSING



LIQUI-JECTOR

continuously removes water, wateroil emulsions and dirt particles from air, gas and steam.

VAPE-SORBER

for continuous removal of water, water-oil emulsions, dirt and petroleum vapor from air and gases.



... COMPRESSED AIR, PROCESS GASES
DRIED CONTINUOUSLY ... AUTOMATICALLY ...
WITH SELAS DEHYDRATOR

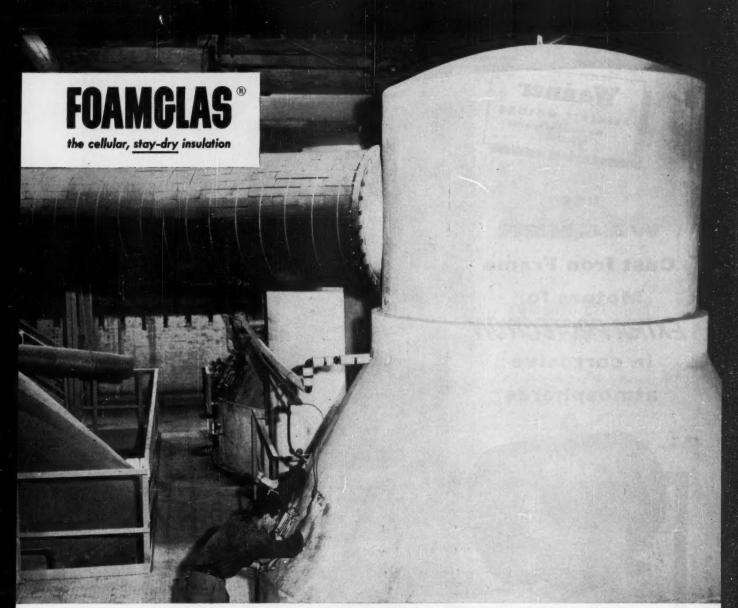
Compressed air, carbon monoxide, carbon dioxide, hydrogen, oxygen, gaseous hydrocarbons, inert gases are dried effectively . . . economically . . . in Selas Dehydrators which are designed for all conditions of processing.

- Desiccants employed are selected to meet moistureremoval requirements. Dewpoints less than -100° F are readily achieved.
- · Reactivation by steam, gas or electric heat.
- Operating pressures range from atmospheric to 6000 psig.
- Inlet temperatures up to 140° F accommodated without refrigeration.

Selas Dehydrators are available for manual, semi-automatic and fully automatic operations, in capacities varying from 10 to 15,000 scfm.

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SELAS FLUID PROCESSING
CORPORATION OF AMERICA • PHILADELPHIA 34, PA.



Contractor: Wm. Summerhays Sons Corp., Rochester, N.Y.

FOAMGLAS insulation stays dry, effective and re-usable for International Salt

reports R. B. Richards, Chief Engineer, New York Evaporating Plants, International Salt Co., Inc.

"Our evaporation process requires an insulation that's high in both efficiency and strength," says Chief Engineer R. B. Richards, International Salt Company, Inc., Watkins Glen, N.Y. "That's why we picked FOAMGLAS to insulate our evaporating pans and piping."

Mr. Richards explains, "Moistureproof FOAMGLAS stays dry and effectively prevents excessive heat loss which would upset the exact temperaturepressure balance our process requires.

"Also we're in the middle of a 4-year construction job, redesigning and renewing our entire evaporation system. Maintaining full production now calls

for constant shifting of pipes and lines. The pre-cut shapes of FOAMGLAS are so strong and rigid that we are able to remove them, move the line and re-use the same pieces of insulation."

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Like International Salt Co., producers of Sterling Salt, you too will benefit from the unique properties of this cellular glass insulation. Send the coupon right away. Pittsburgh Corning Corporation, Dept. H-45
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| Insulation for cold storage space
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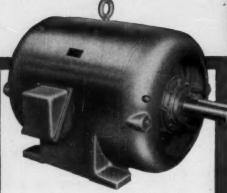
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use WAGNER **Cast Iron Frame Motors** for EXTRA PROTECTION

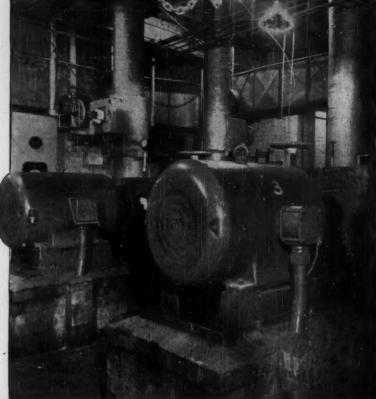
> in corrosive atmospheres



Type EP, totally-enclosed fancooled. Available in ratings from 2 to 250 hp.



Type JP, non-ventilated. Explosion-proof. 1/2 through 11/2 hp.



These 150 hp Wagner Cast Iron Frame Motors drive brine pumps in an acid area at Celanese Corporation's Rock Hill, S. C. plant;

If the motors in your plant are subjected to corrosive fumes and liquids, Wagner Cast Iron Frame Motors will provide the extra protection you need.

These stock motors are totally-enclosed in corrosionresistant cast iron. All parts exposed to the atmosphere are fabricated of corrosion-resistant material-even the nameplate. Features include completely protected laminations ... special varnish treated windings ... a running shaft seal.

Wagner Cast Iron Frame Motors are available in fancooled standard and explosion-proof types in ratings from 2 to 250 hp, and in non-ventilated standard and explosion-proof types in ratings from 1/2 through 11/2 hp. Wagner Bulletin MU-132 gives complete information:

A skilled Wagner engineer will help you select the Wagner Motor to meet your most exacting specifications: Call the nearest of our 32 branch offices, or write us.

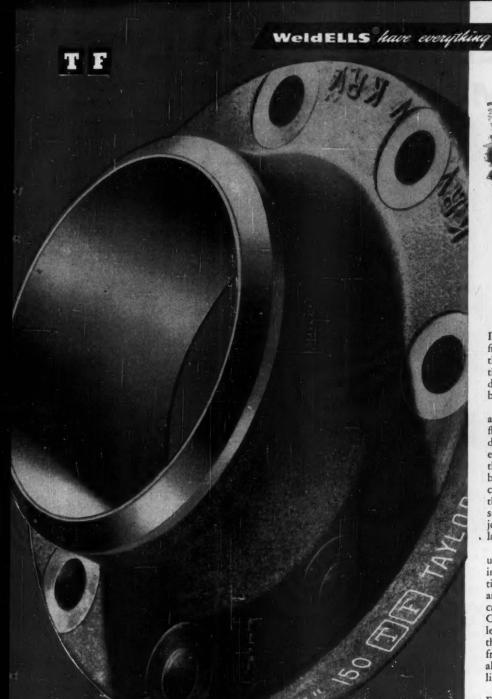
WAGNER ELECTRIC CORPORATION

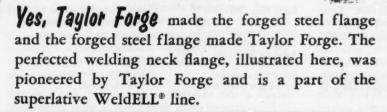
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M55-7





See your Taylor Forge Distributor for up-to-the-minute facts.

General Offices and Works: P.O. Box 485, Chicago 90, Illinoi pericipal cities ... Plants at: Carnegie, Pa.; Fontono, Calif.; Gary, Ind.; Hamilton, Ontaria, Can



Through Evolution to Revolution

In 1929 Taylor Forge announced the first line of welding neck flanges. Although modestly presented at the time, this later proved to be a revolutionary development . . . the forerunner of all

butt-welding fittings.

Actually the welding neck flange was an evolution of Taylor forged steel flange production which had paced the dramatic rise of pressures that started early in the century. The first call from the power and process industries for better ways of containing pressures came as far back as 1910. It was then that the first blow was struck at corrosion and weakness by the Van Stone joint, subsequently perfected by Taylor lap joint flanges and stub ends.

This was the ultimate in pipe joining until torch welding replaced forge welding. Taylor Forge foresaw the possibilities of the torch, and its later affiliate, arc welding. Old timers here like to recall that Taylor Forge was first in Chicago to experiment with oxyacetylene welding as far back as 1905 when the process was brought to this country from France, and that Taylor Forge was also among the early pioneers in metal-

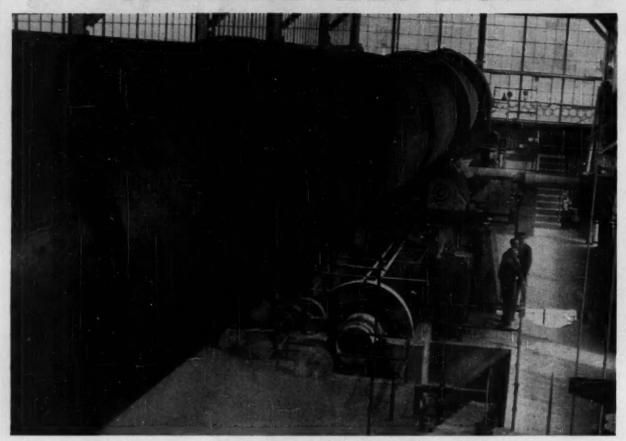
lic arc welding.

It was therefore a "natural" for Taylor Forge to be ready, when on-the-job welding became commercially practical, with the first flange designed for butt welding-the welding neck flange. Taylor Forge thought of it as merely one part of the development of the WeldELL line which had begun in 1926 and was announced shortly after the welding neck flange.

Pressure piping had gone through evolution to revolution.

An episode in the story of Taylor Forge leadership in designed piping

DESIGNED COMPLETELY... COMPLETELY BUILT...



BY VULCAN

Illustrated above is a VULCAN Rotary Kiln 8' x 160' long, used for the calcining of material needed in the manufacture of abrasives. This all-welded kiln, together with a partially submerged and water-sprayed 5' x 40' Cooler under the kiln, was designed and built completely at VULCAN's plant in Wilkes-Barre, Pa.

Since its installation in 1944, this unit has never had any downtime, and is still in perfect condition.

This is another instance of a manufacturing concern contacting VULCAN, and asking them to design and build a complete installation. This installation has proved just as successful in performance as have all other VULCAN complete installations through the years.

If you are planning to build, contact VULCAN of Wilkes-Barre. VULCAN's manufacturing facilities are of the latest, their Engineering Department is fully staffed to offer you answers to any of your problems. Their 106 years of continuous business means experience. You can benefit by this experience in constructive suggestions and preliminary drawings—without obligation (as far as possible). Write today for Bulletin A-422 on Rotary Kilns, Coolers, Dryers, Retorts, and other dependable equipment. If you have a problem, VULCAN will gladly assist you.

Any information on items listed below will be sent to you immediately:

Rotary Kilns, Coolers and Dryers Rotary Retorts, Calciners, Etc. Improved Vertical Lime Kilns Automatic Quick-Lime Hydrators Briquetting Equipment Open-Hearth Steel Castings Heavy Duty Electric Hoists Self-Contained Electric Hoists Cast-Steel Sheaves and Gears Diesel Locomotives Electric Locomotives and Larrys Steel Plate Fabrications Hydraulic Presses

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CABLE ADDRESS
"VULWORKS WILKESBARRE"

a Compact TRACTOLOADER for Close-Quarter Work

Ideal For Handling Bulk Material
in Confined Areas
Unloading Box Cars, Traveling
Unloading Box Aisles and Doorways,
Through Narrow Aisles and Posts
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Has Short $6\frac{1}{2}$ -ft Turning Radius . . . Over-all Length only 9 ft, 7 in., Width 4 ft, 5 in. . . . Plus Other Outstanding Performance and Service Features

Tip-Back Bucket Gets and Carries Bigger Loads 22° tip-back of bucket at ground level gives you "scooping action" for fast, full loading. You also save time getting away with load, hold spillage to a minimum, because bucket tips back quickly to a 50° carry angle at only 3 ft above ground. Low carrying position plus greater tip-back moves load center closer to tractor for better over-all balance.

Torque Converter Drive Works Smoother, Easier ... crowds steadily into the pile, eliminates most shifting, engine stalling and wheel spinning ... greatly reduces tire wear. Tractor's weight plus large drive wheels enables the TL-6 to take advantage of the high, three-to-one torque ratio.

Clutch-Type Transmission Speeds Work Cycle You simply push a single lever to go forward; pull it TRACTOMOTIVE
TL-6 TRACTOLOADER

BUCKET CAPACITY: 1/2 cu yd BRAKE HP: 33.7

SPEEDS O S-----

SPEEDS: 2 forward; up to 10 mph

2 reverse; up to 20 mph

WEIGHT: 6,000 Ib

back for reverse. Reverse is twice as fast as forward to assure the fastest possible work cycles.

Built for Long, Hard Service — filters in hydraulic system and transmission . . . replaceable hardened pins and bushings. All maintenance points easily accessible. Lift and dump cylinders are located well above floor for extra protection from dust.

Ask your Allis-Chalmers Industrial Tractor Dealer to show you the TL-6 in action. See how Tracto-Loader design can speed your operation.

Sold and Serviced by your Allis-Chalmers Industrial Tractor Dealer

TRACTOMOTIVE

TRACTOMOTIVE CORPORATION

Deerfield, Illinois



Tracto-Loaders • Tracto-Shovels • Side Booms and Hydraulic Rippers for Allis-Chalmers Crawler Tractors • Loader and Shoulder Maintainer for Allis-Chalmers "D" Motor Grader.



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"VIRGINIA" ZINC HYDRO REDUCES PAPER MAKING COSTS

Maybe it can save money for you, too

Paper makers wanted a magazine sheet that could be sold for less than pure sulphite. "Virginia" Zinc Hydrosulphite (ZnS₂O₄) was used to brighten low-cost ground-wood to a point high enough so that this brightened furnish when mixed with bleached sulphite produced a sheet of desired color and strength.

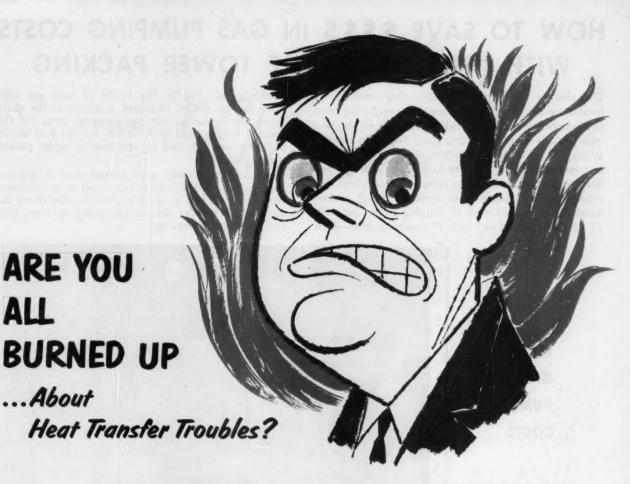
Of course, your business may not be paper making. But "Virginia" reducing and bleaching agents, SO₂, Zinc Hydrosulphite and Sodium Hydrosulphite, are stellar performers in 40 diverse industries. We're always glad to discuss your particular problem.

"Virginia" technical men have the know-how and experience to help you get the quickest answers. Perhaps there are some properties of these "Virginia" Chemicals that you've overlooked. We shall welcome the opportunity of reviewing them in terms of your process, in your plant. Industrial Department, VIRGINIA SMELTING COMPANY, Box 21, West Norfolk, Virginia.



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April 1955—CHEMICAL ENGINEERING



S/V Heat Transfer Oil 600

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If your heat transfer requirements go up to 600°F., you'll find that S/V Heat Transfer Oil 600 is by far the best medium you can use! S/V Heat Transfer Oil 600 is not just another oil originally intended as a lubricant . . . it is a product specially developed as a heat transfer medium - the only product in the 600°F. range with all these advantages:

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- 3. Assures lower maintenance costs because it's non-corrosive. This means longer life for all parts of your system - fewer replacements.
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- 5. Eliminates downtime for clean-outs. Won't form carbon or sludge deposits - heat transfer efficiency remains high.
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Remember, too, that expert technical service goes with S/V Heat Transfer Oil 600 to help you improve your production - cut costs. Call your Socony-Vacuum man today for full details.

Socony-Vacuum Oil Company, Inc.

SEND FOR THIS TECHNICAL BULLETIN

SOCONY-VACUUM

Process Products



SOCONY-VACUUM OIL CO., INC., 26 Broadway, New York 4, N. Y. and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP. 26 Broadway, New York 4, N. Y. Please send me your bulletin, "S/V Heat Transfer Oils." COMPANY_ ADDRESS

HOW TO SAVE \$\$\$\$ IN GAS PUMPING COSTS WITH INTALOX SADDLE TOWER PACKING

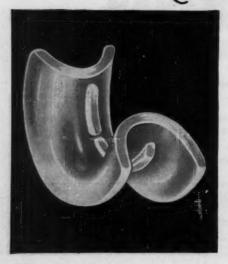
The sharply lower pressure drop characteristics of Intalox saddles effectively reduce tower operating costs in a number of ways. Particularly striking are the savings possible in gas pumping costs. Not only can the savings in initial investment in pumps, blowers, etc., be considerably less, but operating costs, due to lower horsepower requirements, are substantially lowered. For example, if we assume three towers of equal packed height—one packed with 1" Raschig rings, one with 1" Berl saddles and one with 1" Intalox saddles—each

scrubbing, say, 700 lbs./sq. ft./hr. of inert gas with 3,500 lbs./sq. ft./hr. of liquid, a glance at the chart below shows the relative gas pumping costs for the Raschig ring packed tower is 5.6; for the Berl saddle packed tower, 1.9; and for the Intalox saddle packed tower, only 1.3.

The saving is actually even greater than it appears. The use of Intalox saddles can result in a reduction in tower height of as much as 30% in new tower design, which further reduces gas pumping costs, thus compounding the savings.

RELATIVE
GAS
PUMPING
COSTS

1-in. Raschig Rings
1-in. Berl Saddles
1
1-in. Intalox Saddles
1



ORIGINAL LOW PRESSURE DROPS MAINTAINED

A low initial pressure drop is of little value if the packing spalls and crumbles under normal usage. Voids quickly fill and pressure drops rise abruptly. The unique shape of Intalox results in a rigid, interlocking bed with minimum thrust on tower walls and with a minimum tendency to shift and "grind." This, plus the high inherent mechanical strength of the ceramic bodies from which Intalox is made, holds pressure drops at their original low level and keeps packing replacement costs down.

Write for a copy of Intalox Saddle Packing Bulletin 15-29.

U. S. STONEWARE

AKRON 9, OHIO

68E

APRIL

Chementator

● A vast chemical pipeline network linking major chemical producing plants in the Painesville-Ashtabula area of Ohio will soon be proposed. Virtually completed plans call for as many as six individual lines to facilitate intra-company product exchange.

● By one device or another, there's a good chance that oil shale work at Rifle, Colo., will continue through June 1956, despite recommendations by the Interior Dept.'s survey committee that it cease.

New polyethylene process starts stampede

At least nine U. S. chemical firms have plunked down \$100,000 or more each for investigative licenses on a new low-pressure polyethylene process developed by Karl Ziegler of Max Planck Institute, Berlin. And it looks like Union Carbide's Bakelite Co. is going to be first to test market here. Bakelite has confirmed that it's using the Ziegler process—under license—in a new pilot plant at S. Charleston, W. Va., and expects to have samples of the new product out very shortly. Operating conditions are described as "approximating atmospheric pressure and temperature."

Still much in the development stage, the process promises polyethylene that's more rigid than any now commercially available—except irradiated—and that has a softening point of 240 F.—20-30 deg. higher than conventional polyethylene. Use of a metal organic complex catalyst allows polymerization to go at low pressures, even atmospheric. This presents the danger of metal contamination of the end product, which might hurt dielectric properties, but Ziegler's patent claims that water washing removes all catalyst.

Reduced pressure conjures up hopes of lower prices. But it doesn't always work that way. In gas phase reactions, low pressure normally requires larger reaction vessels than high pressure (bigger volume of materials, longer reaction time) and this could offset most of the savings on compressors and wall thickness.

In any case, quality, not hope of a price cut, is

what's attracting U.S. interest because it could bring polyethylene surging into the toy and pipe markets.

Actually, Ziegler polyethylene may have a U.S. counterpart: Phillips Petroleum last year started making pilot plant lots of polyethylene with similar properties, using its own process that runs at about 600 psi.

Big union guns train on chemical industry

This month the CIO's newly hatched oil and chemical union is marshalling its forces for the "organize-the-big-plants" drive decreed by CIO President Walter Reuther. Reuther—who's promised that his United Auto Worker's treasury can be counted on to support the drive—feels that if the infant UAW could organize General Motors, Chrysler and Ford in 1936–37, the new oil-chemical combine should be able to crack Du Pont and Esso in 1955–56.

To delegates at the recent Cleveland convention that formalized the marriage of Oil Workers International Union and United Gas, Coke & Chemical Workers, Reuther also extolled the anticipated merits of the new AFL-CIO federation, declaring that oil, chemical and related fields would be the federation's "number one organizing target."

So now oil-chemical union leaders—eager to live up to their chief's expectations, and possibly make a big name for themselves in the coming federation—are plotting strategy for the march on oil and chemical giants. District directors are being ap-

pointed, organizers selected, budgets estimated. Next move: Formation of CIO organizing committees in some key plant towns. (For a complete analysis of chemical unions, see p. 167.)

More phthalic acid due on West Coast

Add Richfield Oil to your list of phthalic acid suppliers for 1956. Using a process developed by Stanford Research Institute, the firm is already turning out semicommercial quantities of phthalic acids at its Watson, Calif., refinery.

First step in the SRI two-stage oxidation process is air oxidation of petroleum xylene fractions in the presence of a cobalt soap catalyst at moderate pressure and temperature (300 F.). In this step, any ethyl benzene impurity in the feed is removed as acetophenone. Catalyst is recovered, regenerated and recycled. The second stage involves more severe oxidation of the resulting toluic acids. Patents covering both stages are now pending.

One of the keys to the process is the catalyst recovery method. Covered by U. S. patent 2,680,757 (issued last year to SRI's Chester M. Himel), the recovery process appears to be applicable to other liquid phase processes using soluble heavy metal catalysts.

Only other definite West Coast phthalic acid producer is Standard Oil (Calif.), which is now building a 50-million-lb.-per-yr. isophthalic acid unit at Richmond, Calif. Standard's plant will charge purified effluent from its nearby p-xylene plant. Unlike Richfield's process, though, Standard's requires relatively high temperature, pressure and retention time, plus a pure feedstock.

World rushes to nuclear power reactors

Almost faster than we can count them, new plans are revealed for building nuclear power plants—both commercial and research. And just about all—with some justification—claim a "first."

Biggest project is Consolidated Edison's proposed 100,000–200,000 kw. plant near Peekskill, N. Y. It will be the first built with private funds only. (First commercial plant will be Duquesne Light's at Pittsburgh, Pa., but it will be partly owned by the government.) The project will take at least four years and will use a converter, rather than a breeder, reactor. Babcock & Wilcox has submitted the most attractive proposal. (A privately owned commercial reactor is also being considered by Detroit Edison—for Michigan.)

Another first goes to American Machine & Foundry which plans to build near New York the first industry-owned research reactor. (First reactor for industrial research will be built by Illinois Inst. of Technology in Chicago, but it won't be industry-owned). The AMF reactor, using solid fuel, should be operating by late 1956.

Also hoping to score a first, 17 industrial and other organizations, led by Babcock & Wilcox, have started engineering evaluation of the feasibility of a nuclear system using liquid metal fuel—uranium-bismuth. Work's begun at AEC's Brookhaven Lab and a final report is due June 30.

Other countries are pushing hard, too. Recently India said its first nuclear research reactor would be ready in 1957. And Great Britain expects its first commercial reactor to be running in five years, part of a ten-year, \$840 million plan to build 12 atomic power plants for 1.5–2 million kw. Current U. S. government plans call for spending \$200 million in five years for 96,000 kw.

U. S. takes stand in alien property fight

Extremely likely in this session of Congress is action on the return of German assets seized during World War II—including the \$100 million General Aniline & Film Corp. The administration has finally taken a position after a year of interagency squabbling.

The government is ready to pay off individual Germans whose property was vested up to \$10,000 per claim, to sell GAF to American bidders and to return most of the thousands of vested patents and copyrights to their original owners.

Nobody's really happy with the compromise proposal except GAF. The Germans—and their backers in Congress—want the full \$450 million worth of seized property returned. Francis Brown, president of American Schering Corp., is fighting any return. He fears the move might lead to eventual return of all vested property which would give his former German parent firm, Schering, A. G., a \$30 million windfall profit.

Nontheless, Congress will probably buy the proposal if the administration finally decides to send it to Capitol Hill.

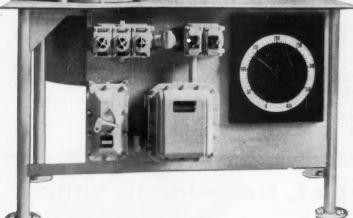
Unique: A one-step fatty acid process

To use just one tower to fractionally distill, deodorize and purify—in just one pass—a whole raft of feed stocks has long been a goal of fatty acid producers. And now it's been accomplished.

As a matter of fact, John E. Schulze and Sons,

(Continued on page 108)





Here is a packaged pilot plant . . . designed for resin experimentation . . . in five gallon capacity and standardized design . . . with interior surfaces of stainless steel.

It's flexible enough to handle hundreds of small operating tests ... accurate enough to permit projection to full scale plant operation... and priced to fit into modest research budgets—even with the adaptations we are prepared to make to fit your most specialized research needs.

Check these specifications against your needs:



REACTOR: 150 PSIG design pressure. External electric strip heaters. Internal cooling cylinder. Thermostatic controls. Variable speed agitator with hollow shaft for injection of gases into material.

CONDENSER: Arranged to operate in any position. Additional condenser may be hooked up for use as a still.

DECANTER: Again, stainless steel is used for all surfaces in contact with the contents. 1½ quart capacity with sight glass.

INSULATION JACKET: Arranged to protect main body of the vessel from heat losses. Can be dropped to service the electric heaters.

Additional connections are available for hooking up extra condensers, instruments and controls.

And—the unit shown is just one of p-k's line of standardized pilot plants and autoclaves from five and ten gallon capacities and up.



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CHEMICAL ENGINEERING—April 1955

105

Dorr-Oliver PUMPS

For Highest Operating Efficiencies in Handling All Types of Liquids, Sludges, Slurries in Small or Large Flows

Whether you need a pump for handling clear liquids, corrosive or abrasive liquids or liquids containing a large percentage of solids, there is a Dorr-Oliver pump that will do the job more efficiently.

Backed by 51 years of manufacturing experience, each pump is precision designed and built to deliver maximum flow, give long

life with minimum maintenance cost.

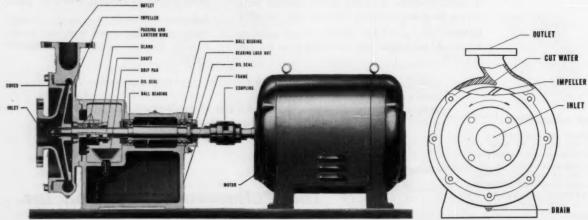
Illustrated, are the complete line of Dorr-Oliver pumps for the chemical, metallurgical and sanitation industries. Dorr-Oliver engineers, specialists in pump application, will gladly discuss your pumping problems.

Write for their assistance.

OLIVER Type L Centrifugal Pump

The Type L is a corrosion resistant chemical pump featuring a high cut-water or tongue of the volute (see sectional drawing bottom right). This makes the pump self venting... improves priming. Available in four stand-

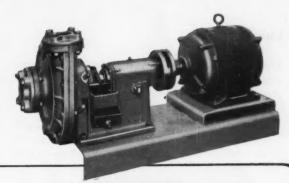
ard sizes — 1", 1¼", 1½" and 2". Contact parts, except 1", are made of Carpenter 20 or No. 316 stainless steel, bronze or cast iron. 1" model in Carpenter 20 stainless steel only. Write for Bulletin No. 310.



OLIVITE® Acid Handling Pump

An efficient, durable pump for handling hot or cold acids and corrosive solutions. Special rubber or neoprene base composition covers casing, cover and impeller. It does not crack or slough off even under high temperatures. Sizes available — 1¼", 2" and 4". Write for Bulletin No. 308-R2.



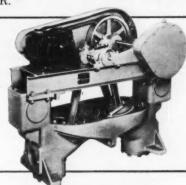


OLIVER Diaphragm Slurry Pump

This pump is designed to operate without mechanical linkage for transmitting force to diaphragm — source of power is compressed air. There is no motor, stuffing box or packing. Capacity quickly changed from zero up without stopping operations. Pump can be shut off while running. Six sizes available. Write for Bulletin No. 309-R.

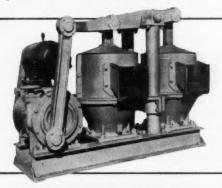
DORRCO Type V Pump

For removing underflows from Thickeners and Hydroseparators by positive displacement. Twin pumping chambers with individual suction and discharge connection for each chamber. Adjustable stroke while pump is running. Six sizes to handle up to 30 cu. ft. of pulp per minute. Write for Bulletin No. 5001.



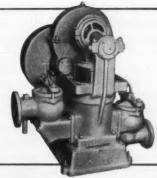
DORRCO Type W Pump

A rugged duplex diaphragm pump designed for big tonnage operation featuring variable stroke adjustment while pump is running. Available in 6" and 8" models to handle up to 75 cu. ft. of pulp per minute. Write for Bulletin No. 5002.



DORRCO Plunger Pump

A dependable unit for pumping sludges in municipal and industrial water and waste treatment plants. Adjustable eccentric permits stroke variation of 1" to 5". Can be controlled by program time clock for optimum 24-hour operation. Write for Bulletin No. 5182.





Chicago, has been secretly running a plant using such a process for nearly four years. But the word didn't get out until Bell and Gossett Co., a maker of heat exchangers and heaters in Morton Grove, Ill., recently purchased Schulze. What B & G got was a plant able to charge 30 tons of raw material a day (now being doubled in size). More important, they acquired the Schulze one-step process.

Main claims made for this unique method are these: It cuts operating costs by as much as 50%; and capital investment is about one-third that of conventional units, mostly because only one tower is needed—no rerunning for odor, color or purity control—and because dry, high vacuum fractionation is used—no steam or other distillation aids that up tower diameter requirements.

So far the process has been used successfully on tall oil, crude fatty acids from soya, coconut, cottonseed and red oils and tallow. Yields naturally vary with the amount of unsaponifiables in the feed, but the company says the range is 80–95%.

Tower top pressure is 0.5–1 mm. absolute and pressure drop is about 10 mm. Most conventional techniques, says Schulze, have higher pressure drops, therefore high temperatures. This process can run at temperatures 100–150 F. lower than conventional processes to give the same products.

At least one other firm is ready to try out the process: West Virginia Pulp & Paper will install—probably by June—a \$500,000, 50-ton-per-day tall oil unit at Charleston, S. C. Most other firms in the field have adopted a show-us attitude. But just about all of them also confide that if Bell and Gossett can really do what they claim in one tower, they've got something.

Potent prospect in manganese recovery

Dubbed by the General Services Administration as the most promising work in recovering manganese from low-grade ores,* a new Manganese Chemical Corp. process is now entering semicommercial stages. The firm's plant at Riverton, Minn., currently runs at half capacity—100 tons of ore daily—produces 50,000 lb. a day of very pure manganese carbonate. Full production is expected shortly.

At Riverton, ore from the Cuyuna range (actually low-grade iron ore containing 10–15% manganese as MnO₂) is roasted to MnO in a shaft furnace. The roast is ground to about minus 35 mesh, then slurried at room temperature with a solution of ammonia and carbon dioxide in which it dissolves

by forming a complex salt—manganese ammonium carbonate.

The solution is thickened to 1-1½ lb. of salt per gal. and heated with steam. This drives off ammonia (which is absorbed and recycled) and manganese carbonate precipitates. Centrifugation and drying—at 200-250 F.—complete the process.

Final product is a pure manganese carbonate powder of about minus 325 mesh that's easily converted to MnO₂ nodules for use in steel making, or to other manganese salts.

With commercial production still a ways off, MCC will say only that yields are high and that the process promises to be very economical. Backing these up are the facts that all equipment can be made of mild steel (not true of other acid processes), only manganese is leached from the ore, any manganese deposit except silicates can be utilized, and all reagents are volatile, hence easily recovered.

Tariff cuts fire industry ire

President Eisenhower's foreign trade program is meeting stiffer opposition in Congress—and industry—than was expected. And the chemical industry is in the thick of the fray. Still, administration and congressional leaders think the President will get most of what he wants.

The reciprocal trade bill will almost certainly pass the Senate. (Senators are less responsive than Representatives to pressure from individual industries worried about import competition.) But sections of the chemical industry are working hard to tie a tougher "escape clause" onto the bill to make it easier for domestic industries threatened by imports to get tariff boosts. They are also pushing various amendments to give special protection to defense-supporting industries.

Such general amendments have a chance, but attempts to legislate controls on imports of specific commodities—notably chemicals and oil products—look almost certain to fail.

The revised General Agreement on Tariff and Trade (GATT) will have rough passage in Congress, rocked partly by protectionists in the chemical industry. GATT is the international organization within which all postwar tariff cuts have been negotiated.

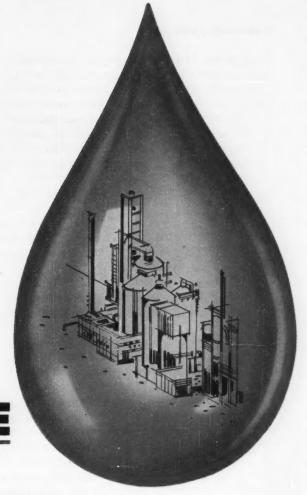
Opponents hope to kill the reciprocal trade program by killing GATT or postpone tariff cuts next year by stalling action. The fight could go either way.

Also hanging fire are Japanese tariff negotia-

(Continued on page 110)

^{*}For details on some other new and promising manganese recovery processes, see Chem. Eng., Oct. 1954, p. 122 and Feb. 1955, p. 104.

Here I Sinclair TOLUOL XYLOL PARAXYLENE and HEAVY AROMATICS



Completion of the Sinclair Aromatics Unit at Marcus
Hook, Pa., Refinery means that a *new* and *dependable* source of supply of important petro-chemicals is now available to you. Designed for quantity production of high-purity Toluol, Xylol, ParaXylene and Higher boiling aromatics, this new Sinclair unit is a big step forward in meeting a basic industrial need.

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tions among 15 nations in Geneva. Participants are racing against a June 12 deadline, for after that U.S. authority to cut tariffs on many products up for bargaining will be curtailed. Synthetic organic chemical makers have a major stake in these talks since the U.S. is offering tariff concessions on a long list of coal tar products and other chemicals to third countries—including Germany—in exchange for their concessions to Japan.

New role and market for glycerine

Use of glycerine to preserve living cells at low temperatures, discovered five years ago, seems to be edging closer to practical utility.

In its most important application—preservation of red blood cells—the major obstacle of what to do with the glycerine at the time of transfusion has just been surmounted. And there's continued rapid progress in the storage of bull semen and tissue, such as human cornea and skin.

Blood cell storage particularly could be a hefty market for glycerine. Most research indicates that 30% by volume of glycerine is optimum. About 3 million pints of blood are now collected annually for civilian use; and during one year of the Korean War total collections topped 5 million pints.

Basis of the new method is "suspension of life," a long-time dream of biologists. Most living matter is extremely sensitive to cold, and freezestorage was considered impossible until it was discovered that glycerine protects cells from fatal effects of freeze-thaw cycles.

Red blood cells, for instance, when mixed with buffered glycerine solutions can be frozen and stored at —110 F. for over a year with little deterioration. Moreover, they survive normally after transfusion. With present techniques whole blood can be stored only about three weeks, so red cells are usually discarded after plasma is extracted.

"Frozen blood banks" are still in the research stage, partly because it's been thought necessary to remove glycerine before transfusion. Now, though, Dr. Henry Sloviter of the University of Pennsylvania has devised a simple way to convert thawed cells and glycerine to a suspension suitable for transfusion as is. So frozen banks may soon be realities.

Pollution: Much talk on Capitol Hill

Air and water pollution abatement is bobbing brightly in the Washington legislative stream but there's still considerable question as to which of several bills—each embodying a different approach—may emerge as law.

The latest move came early in March—a bill to authorize funds for pollution research and provide a revolving loan fund to help finance installation of abatement equipment. Other approaches in the works: encouraging installation of abatement equipment by allowing five-year depreciation; extending the 1948 water pollution control act, making it permanent.

Hearings on the extension—advocated by the administration—began March 10. Chances of this becoming law are fair-to-good. Not for rapid depreciation, though. Treasury officials think the proposed bills don't adequately define what is an abatement device and what is an integral part of a manufacturing process. Even if passed, they would likely be vetoed.

The chances for laws to provide research and loan funds are only fair, with the odds better on research funds than on loans. The President's interdepartmental committee on pollution is now programming possible research projects and estimating costs. If and when this list goes to Congress, money may be authorized.

Profit from safety-in dollars

Can safety programs actually save you money? Judging by one firm that's saved \$699,000 in six years through its program, they sure can.

Smith-Douglass Co., at one of its large fertilizer plants, has cut the accident frequency rate from 41.53 to 3.92 since 1947. Because Workmen's Compensation insurance premiums are based on this rate, it's meant not only better employee morale, but big money for the company, too.

Here's why: At the high rate the company's insurance cost 23.6% more than the average in the industry—\$61,850 instead of \$50,000 on its 1947 payroll. But in 1954, when the rate hit 3.92, the firm earned a 35% credit, thus paid only 65% of the normal premium—a saving of \$17,500 over normal, \$29,350 over what it would have been had the high frequency rate prevailed.

The firm's total premiums since 1947 have been \$221,000, rather than \$370,800 which would have been required at an accident rate of 41.53. This gives direct savings of \$139,000 in six years. And since indirect accident losses—lower productivity, costs of training replacements, accounting costs—are generally considered to be four times direct losses (premiums), Smith-Douglass figures it's saved a total of \$699,000. That's a mighty good argument for organized accident prevention.

For more of WHAT'S HAPPENING.....112



To serve you promptly, Shell Chemical has established complete denaturing plants in key industrial centers.

Shell Chemical's ethyl alcohol is of the highest quality, meeting or surpassing all Federal and commercial specifications for purity. It is available as pure alcohol (190 proof), in specially and completely denatured grades, as well as in a proprietary solvent—Neosol®.

Next time you need ethyl alcohol, remember that Shell Chemical bulk distribution facilities are as close as your telephone . . . ready to make the fastest possible delivery . . . in drums, tank trucks, compartment trucks, tank cars or compartment tank cars.

Your Shell Chemical representative will be glad to discuss your alcohol supply problem with you. Write or phone your nearest Shell Chemical office. Send for "Organic Chemicals," SC:53-18, a catalog of our complete line of other solvents, intermediates and resins.

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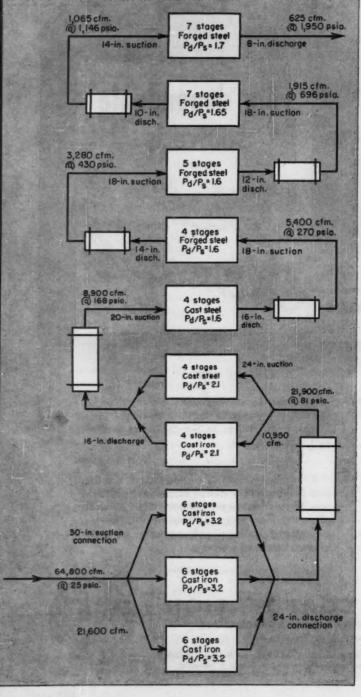
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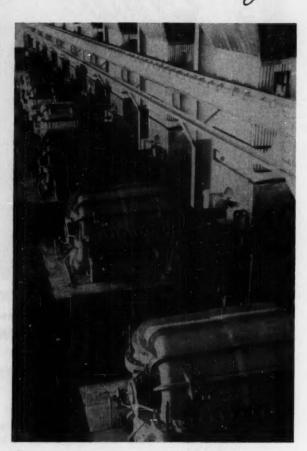
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APRIL 1955

What's Happening





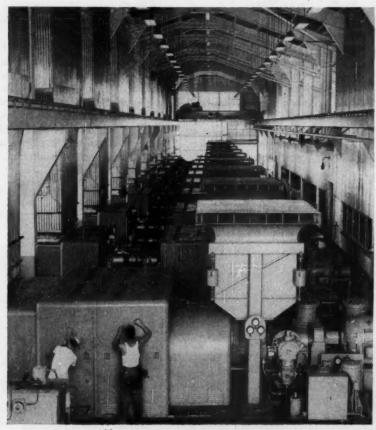
Centrifugal compressors in balanced stages

Powered by Waste Gas,

This trailblazing installation of gas turbine-driven centrifugal compressors features Creole Petroleum Corp.'s new \$20 million gas conservation plant in Venezuela.

The plant uses ten specially designed and constructed compressors, each direct-driven by a 6,000-hp. two-shaft gas turbine. This is said to be the largest concentration of gas combustion turbines in the world.

in Chemical Engineering



draw 6,000 hp. each from ten two-shaft gas turbines.

Compressors Up Oil Output

Located seven miles offshore and built on a platform over the waters of Lake Maracaibo, the plant gathers gas which has been separated from oil produced in the area, compresses it to 1,935 psi. and returns it to the producing formation through five injection wells at a rate of 137 million cu. ft. per day. Another 17 million cu. ft. per day of gas powers the turbines.

Reinjection of gas into the field at high pressure is boosting immediate rate of oil production by 50%. It's also expected to increase ultimate production by one-third.

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▶ Pioneer Engineering — To minimize vibration of the huge pile-supported platform (see cut, next page), Creole's designers turned to centrifugal compressors. And economic studies showed that gas turbines were the logical choice for driving the compressors.

At the time of the design studies, however, no large installation of centrifugal compressors had ever been made for discharge pressures above 1,000 psi., and experience with gas-fired combustion turbines was limited.

Disregarding lack of precedent, Creole engineers forged ahead and now, with valuable help from General Electric and Ingersoll-Rand, the project has become a reality. In January, after a year and a half spent in construction and a short period of trial operation, the new plant was formally christened.

Stages on Stages—The compressor installation uses a unique seriesparallel arrangement of ten individual multistage machines. Three machines in parallel form the "first stage," two in parallel form the "second stage" and the other five units are connected individually in series, as shown in the diagram.

Adding up the number of stages in series compressing any one pound of gas, the total is 37 in seven machines.

Casings for the three first-stage units are of cast iron, the two second-stage units and the third-stage unit are of cast steel, and the four high-pressure units are of forged steel. There are intercoolers between all series-connected machines; no diaphragm cooling is provided inside the individual compressors. Condensate is removed between all stages.

Striking a Balance-Ingersoll-Rand's engineers spent the better part of a year designing the compressor system. By skillfully juggling volumetric loads and compression ratios they were able to specify a combination of ten machines all running at the same speed and re-

quiring approximately the same power input.

This feat greatly simplified the turbine installation, making it possible to use ten identical units. The turbine air compressors operate at 7,500 rpm. The power rotors driving the compressors run normally at 5,100 rpm., with overspeed trip at 6,000 rpm.

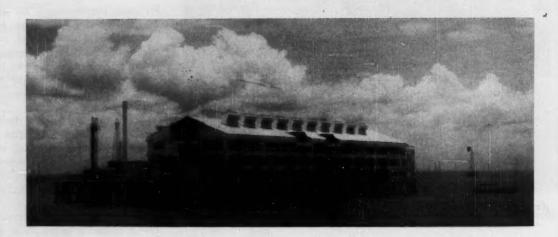
Two-shaft turbine design offers maximum flexibility in output speed. Operators can thus vary speeds to get close control of compressor performance.

Any one machine can be out of service while the other nine still provide the desired system discharge pressure. Reduction in throughput with a compressor or turbine down varies from 8% for a first-stage unit to some 25% for a sixth or seventh-stage unit.

► Lube Oil Savings—Aided by extensive instrumentation, Creole expects to operate the plant at a much lower cost than a conventional reciprocating-type plant. One of the largest savings hoped for is in lower consumption of lubricating oil.

Nearly 10% of the world's crude oil supply now comes from the Lake Maracaibo area. Creole Petroleum Corp., an affiliate of Standard Oil (New Jersey), claims to be the world's largest oil producer.

Designated as Tia Juana No. 1, the new conservation plant is the first of several that are planned in order to utilize more effectively the gas from the field. Creole President H. W. Haight predicts that when the program is completed, 80% of the gas produced will be efficiently consumed or stored by reinjection.



Sixty Thousand Horsepower Over the Sea

Construction of Creole Petroleum's over-water compressor plant and underwater gas gathering lines posed some challenging engineering problems.

The platform stands 14 ft. above the water and some 80 ft. above the bed of Lake Maracaibo. Its foundations consist of 350 reinforced concrete piles, each 28 in. square and 165 ft. long.

Piles were prefabricated at Creole's casting yard on shore. According to Creole, they represent a substantial saving over caisson-type piles normally used in water of this depth. Beams, floor sections and turbine-compressor support boxes were also precast on shore.

The gathering system, consisting of some 65,000 ft. of 24 to 30-in. pipe, lies on the bottom of the lake. Protection of the pipe against corrosive effects of the brackish lake water and marine termites, plus the need to counteract the bouyancy of the pipe, required special preparations.

Pipe was coated with asphalt, wrapped with glass cloth and then with heavy wire mesh, finally surrounded with some 41 in. of concrete cast around it. Laying this extremely heavy pipe—562 lb. per lineal ft. for 30-in. pipe—in 65 ft. of water was a major undertaking.

Brown & Root, Houston, Tex., engineering firm, handled the entire construction job for this project.

LION OIL COMPANY



J. B. ROGERSON, MANAGER OF MANUFACTURING

UMMUS EDDORADO ARKAYSAS

October 29, 1954

Mr. C. A. Barrere Vice President The Lummus Company 2707 Weslayan Houston 6, Texas

Dear Mr. Barrere:

DATE REC'D: ROUTE TO:

The construction of our chemical plant in St. Charles Parish, Louisiana, to produce 300 tons per day of ammonia 450 tons per day of ammonia, 450 tons per day of nitric acid, and 550 tons per day of ammonium nitrate pellets was completed by your company June 1, 1954, and was well within labor cost and time allocated to this project.

Please extend our sincere compliments to all of the people in your organization who worked on this project for a job well done.

Yours very truly.

ON OIL COMPANY

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THE LUMMUS COMPANY, 385 MADISON AVENUE, NEW YORK 17, N. Y.

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

FULL-SCALE equipment, even as big as 20 tons, will feature exhibition.



FULL SLATE of technical papers is scheduled for a truly rounded program.

Chemical Show of Shows

In May chemical engineering goes international—at the famous German chemical exposition and congress, ACHEMA XI. Exhibits will come from 12 countries.

Ever-increasing importance of chemical engineering in Europe is evident from extensive plans just announced for a vast international chemical exposition and technology congress at Frankfurt, Germany, May 14-22.

Known as ACHEMA XI, it will be the 11th in the renowned series of such affairs that since 1924 have been sponsored by Dechema (Deutsche Gesellschaft fuer Chemisches Apparatewesen). More than 800 firms from 11 foreign countries and the U. S. will display recently developed process equipment, materials and instruments.

Dr. Herbert Bretschneider, managing director of Dechema and one of the founders of the European Federation for Chemical Engineering, is chiefly responsible for the impressive program. He also initiated and edited the new ACHEMA Jahrbuch 1953-1955, a comprehensive catalogue of European chemical plant equipment. It will go to all participants in ACHEMA.

▶ More Than Just a Show—Unlike many exhibitions that are limited to showing equipment, ACHEMA concentrates heavily on technology. The 1955 Congress of the European Federation for Chemical Engineering will bring together representatives of 23 European technical societies. Lectures by 77 scientists, engineers and industrialists from 16 countries are scheduled for 19 technical sessions. These will be followed by formal discussion from 58 participants.

Prominent among the lecturers are Karl Winnacker, chairman of Farbwerke Hoechst and president of Dechema, Kurt Riess and U. Haberland of Leverkusen, K. Hauffe of Oslo, L. Hagdahl of Stockholm,

E. Wiedemann of Basel, P. Grassmann and H. Mohler of Zurich, P. Chevenard of Paris, R. Gibert of Nancy, G. A. Dummett and H. Ford of London, and F. F. Jaray of Worcester.

Adding to the congress's international flavor are three American speakers: Melvin C. Molstad of the University of Pennsylvania (on leave as Fulbright professor at Trondheim) will discuss "Estimation of Chemical Plant Investment and Operating Costs." Emil A. Aries of R. S. Aries and Associates will analyze methods of licensing and financing foreign chemical operations. And Sidney D. Kirkpatrick, editorial director of Chemical Engineering and Chemical Week, will review "Historical Development of Chemical Engineering in the United States."

► Huge Floor Space—Housing for ACHEMA will be in a group of buildings that cover over 50 acres. The 11 exhibition buildings have 500,000 sq. ft. of space.

More than half of this—260,000 sq. ft.—will hold process equipment, machinery and even whole plants to be shown by 402 companies from 12 countries. Construction materials will take 75,000 sq. ft. for 115 exhibitors from 6 countries. Recording and control instruments will be shown by 85 firms from 5 countries in about 40,000 sq. ft. Packaging equipment has been allocated 29,000 sq. ft., plastics 14,000 sq. ft., safety devices 3,800 sq. ft.

Rounding out the week, 44 plant and laboratory visits are scheduled for German chemical industries at Frankfurt, Mainz, Ludwigshafen, Mannheim and other nearby industrial centers.



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GENERATING PLANT, one of three of 66,000 KW each, installed for electric utility company in Southwest.



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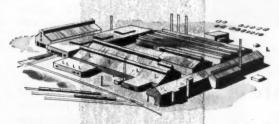


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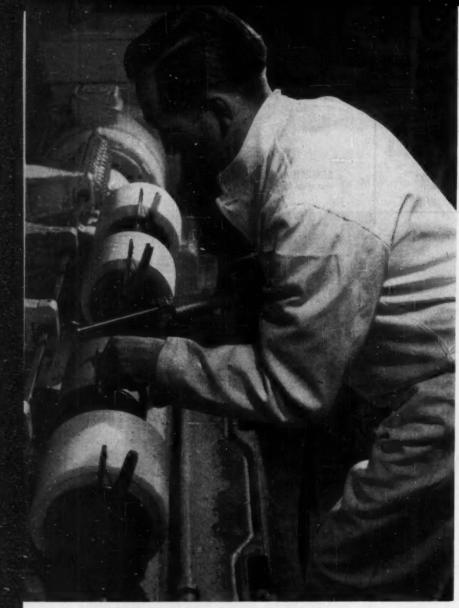


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ICI'S TERYLENE fiber swells the flood of products made from . . .

Polyethylene Terephthalate

New plants in U. S., Canada and England, with investments totaling upwards of \$200 million—are turning out increasing quantities of polyester film and fiber.

Commercial production of film and fiber made from polyethylene terephthalate is reaching flood stage this month. Here are the latest developments in this fast moving field:

Canadian Industries (1954)
 Ltd.'s new \$20 million Terylene
 fiber plant at Millhaven, Ont., will make its commercial debut this

month, with full rated capacity of 5,000 tons per year expected to be reached by the end of June.

• During this same threemonth period Du Pont will be bringing into production its new plant at Parlin, N. J., for making Cronar photographic film base.

• Third member of the PETP team, Britain's Imperial Chemical

Industries Ltd., recently started up its Terylene fiber plant at Wilton at a rate of 1,100 tons per year, expects to be making 5,500 tons by the end of 1955 and 11,000 tons per year by 1956.

▶ Huge Investments—In a relatively short period of time these three companies, together with their suppliers of raw materials and intermediates, have sunk huge sums of money into research expense, pilot plants and commercial-scale facilities.

Du Pont is well on its way to the \$100 million mark. Its plant at Kinston, N. C., which has been making Dacron fiber for two years, cost \$40 million. (Plant capacity is in excess of 17,500 tons per year.) Cost of the Circleville, Ohio, Mylar film plant, which began production last October, was \$10 million.

In addition to the \$50 million tied up in these two plants, Du Pont has invested additional unrevealed sums in the Cronar film plant at Parlin and a dimethyl terephthalate plant at Gibbstown, N. J. The latter facility supplies DMT for all three Du Pont PETP-based polymers.

In research on PETP films alone, Du Pont spent at least \$8 million— \$5 million on Mylar and \$3 million on Cronar.

To supply CIL's \$20 million Terylene plant at Millhaven with dimethyl terephthalate, Hercules Powder Co. is bringing on stream this month a new plant at Burlington, N. J., costing \$4 million.

▶ Basic Material Supplies—Du Pont and Hercules both buy paraxylene, precursor of DMT, from various petroleum refiners, whose investments in paraxylene production and refining facilities reach sizable proportions. Among these companies are Oronite, Phillips, Humble and Sinclair.

The other major intermediate required for making PETP products is ethylene glycol. Du Pont is utilizing part of its Belle, W. Va., glycol output to supply some of its requirements for Kinston, but must buy additional quantities from other glycol makers. Investment in facilities for making glycol—and ethylene and chlorine, basic raw

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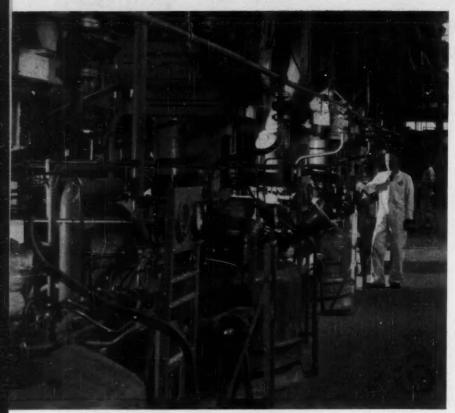
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POLYMERIZATION of DMT and glycol takes place in these autoclaves.

materials—adds still more to the already vast sum tied up in the overall PETP picture.

▶ Integrated ICI Facilities—Imperial Chemical Industries is building at Wilton a closely integrated complex for producing Terylene. When completed next year it will represent an expenditure approaching \$60 million.

ICI makes its own ethylene by cracking a suitable hydrocarbon, converts ethylene to ethylene glycol. The company buys crude xylenes from the petroleum industry, separates the para isomer to make terephthalic acid and then dimethyl terephthalate.

Ethylene glycol and DMT are copolymerized to form polyethylene terephthalate (see cut above), which is extruded from the polymerization autoclaves as a molten ribbon onto a water-cooled casting wheel. The sheeted polymer is broken into chips, pneumatically conveyed to temporary storage.

Just prior to remelting and spinning, the chips go through a rotary dryer to remove any residual moisture. The polymer is then melted and spun into fiber by pumping at high pressure through spinnerets.

Transatlantic Round Trip—PETP fibers and film had their origin in work done 25 years ago by Du Pont's Wallace Carothers of nylon fame. For various reasons—some technical, some economic—Du Pont (and Carothers) turned to polyamides, developed nylon to commercial fruition, let the polyester discovery lie fallow.

Meanwhile across the Atlantic, in 1940, J. R. Whinfield of Calico Printers Association got interested in polyesters, read up on Carothers' work. With later support by ICI, this work led to Terylene fiber.

Du Pont, too, had taken another look at polyesters and came up with a process quite like ICI's. Du Pont got a license to use the British developments and, with characteristic speed, reached large-scale commercial production of Dacron two years ahead of ICI's Terylene.

▶ More to Come?—In addition to

the plants now in operation in England, Canada and United States, more PETP fiber may soon be coming from other European plants. ICI has licensed firms in Italy, France, Netherlands and West Germany.

ICI is turning out development quantities of a PETP film-known as Melinex-at its Welwyn works. Future plans for expanding Melinex production are as yet uncertain, says ICI.

In this country rumors were circulating last year that Du Pont was considering another Dacron facility at its Old Hickory, Tenn., location. The company now denies any such intention, saying that capacity at Kinston is sufficient, at least for the present.

New Government Agency Keeps Tab on Minerals

The Office of Minerals Mobilization, a newly created agency in the Dept. of the Interior, is going to be responsible for adequate supplies of certain metals, minerals and facilities for both civilian and military requirements. Solid fuels are included.

OMM's program includes developing data on productive capacities and supplies (both foreign and domestic), recommending establishment or modification of expansion goals and formulating necessary foreign minerals exploration programs. In addition, it will aid the General Services Administration in screening requests for fast tax write-offs, loans, guarantees and procurement contracts for metals and minerals.

Wet-Strength Resin Expansion Under Way

Early this spring Hercules Powder Co. will have finished additional facilities for making wetstrength paper resins at Holyoke, Mass. The company cites increased use of these products, known as Kymene, in V-board, toweling, paper for food and meat packaging and other specialty applications.



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Whether you buy "United Tubond" or expanded, you may be sure you are getting a product with the grade of lead, thickness of lining, and method of joining calculated to give you your money's worth in strength and corrosion resistance.

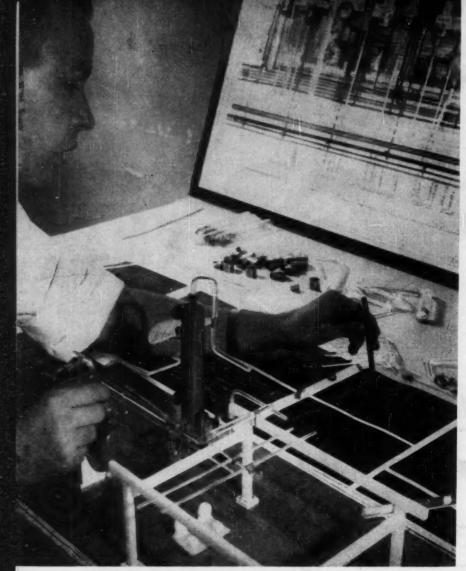
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FROM MODEL KIT and photos, final construction plans that open a . . .

Shortcut to Plant Startup

By uniquely combining a new time-saving modelmaking technique and photo production of plans, engineering time is slashed 30%, cost reduced 40%.

Plant design manhours cost money and eat up time, pushing startup dates further into the future. Engineering firms are acutely aware of this problem.

In a bold departure from convention Parco Co., New York, has hatched a new technique that simplifies design of plant layout. With the technique firmly established in its own drafting room Parco now is offering it on a fixed-price and license basis.

▶ Design Condensed — In Parco's PDQ technique you assemble prefabricated "erector-set" model components—without previously drawing plans. Then by a new photographic process you make engineering construction plans directly from the completed model.*

PDQ Saves Time and Money

Basis: 75 Equipment Units, 300 Lines

	Conventional Procedure	PDQ Method
Manhours	4,350	1,650
Men	8	4
Time, weeks	17	12
Model cost	\$20,000	Included
Design cost	\$24,000	\$14,500
Time savings		30%
Cost savings		40%

With this technique the model becomes a complete working tool for producing plans. Equipment arrangement and piping are proved out while being conceived, not after plans and more expensive models have been made.

A breakdown of costs for conventional piping and arrangement drawings vs. PDQ is shown in the table.

▶ Realism in Designer's Hands— The new technique stems from Parco's belief that the design engineer is the person best qualified to assemble a plant model. Only hitch is that designers generally are not expert model makers; to acquire such abilities would be costly in time and money.

Parco has jumped this hurdle by giving the designer a method that requires no special skills. Model components, furnished in kit form, enable the designer to assemble the model right in the drafting room. There is no need for a shop or tools other than a cutting tool.

Kits contain scale models of various components of equipment, piping, valves, fittings, structures, etc. Size and number of desired components are ordered from Parco; models of special equipment can be ordered for prompt fabrication and shipment.

▶ From Model to Plants—Once the model is completed you photograph it right in the drafting room. Parco furnishes special know-how and equipment to supplement standard photographic procedures. Means are employed to eliminate shadows.

From each photo of the model showing sections, elevations or key plans, you make a transparent master film, full engineering-drawing size. You simply add the neces-

^{*}Patents have been applied for on the model kit components and the "erector-set" method of assembly, on the photographic process for producing key plans, and on the combined use of models and photography to produce finished construction plans.

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Richard L. Commerce

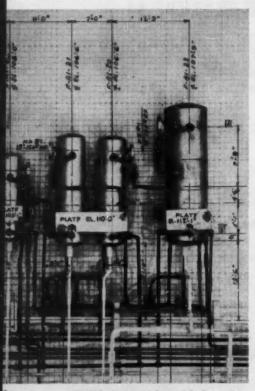
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The Patterson Foundry and Machine Company, (Canada) Limited Toronto, Canada



FILLER piece goes here if you need to adjust exchanger length.



PLAN view complete with dimensions ready for construction gang.

sary dimensions directly onto these films. Erasures can be easily made; additional equipment or lines can be added at will.

Parallax brings about a threedimensional effect, giving the illusion of depth without confusing or detracting from the basic purpose of construction plans. This brings the advantages of a model to all points in the field without need for the model itself to be there. To supplement the photo plans, you can provide field construction personnel with stereo shots of the model.

▶ Tying in Details—The PDQ technique can reduce time required for specialized work on stress analysis and pipe supports. All supports are identified on the model at their proper locations and appear on the photo-key plans. Details of the supports are shown on separate sheets or the design standards, and are properly tied in with the photo-key plans.

For general design studies, the PDQ technique has been found very convenient. Model assemblies, such as typical piping hookups for pumps, compressors and vessels, can be used during discussions with contractors, field forces, clients and vendors. Equipment models can be piped up, studied, then changed in short order without resorting to shop operations.

▶ Sectionalized — Structural members, designed like erector-set components, can be assembled by an unskilled person without need for shopwork. Standard length, vertical plastic members in various thicknesses are fitted with magnetic footings or bases. Each member is drilled to take dowels for connecting together into a structure.

For multilevel structures, the superstructure has slots in the vertical members which receive each level, platform or floor. Equipment that runs from one level to the next is actually assembled in sections with the lower portions held to the floor overhead by magnets. Piping is handled in the same manner. These features permit an entire level or floor to be lifted easily for photographing.

The base for each area, floor or

section is metal-clad plywood marked with squares to scale. Vessel saddles and foundations supports are magnetized metal that adhere firmly to the base. Equipment can be permanently secured to facilitate shipment.

▶ Change at Will — Individual equipment and piping components are designed for complete flexibility during development of the layout. Towers, for example, come to scale for diameter increments of 1 ft. and in various lengths to the tangent line of the dished heads. After the position of the vessel is established the heads are added. Filler pieces are used to make the vessels higher and longer, or lower and shorter, as needed.

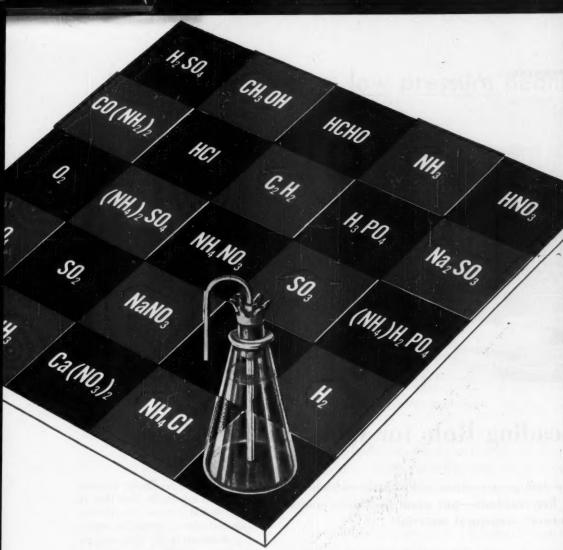
Tower and tank platforms in the desired shape have magnetized strips on the bottom to hold them in place on steel pegs extending from the vessel. To shift platform location you pull out the steel pegs and push them into the soft wooden vessel at a new position.

Piping components scaled to a wide range of diameters include bends, offsets, loops, etc. Made of plastics, they come in a wide variety of colors so that various tones will be reproduced on the photokey plans to facilitate identification of lines.

One objectionable problem in constructing conventional models is the difficulty in making changes to keep up with the design being developed on the drawing board. The PDQ methods for fabricating equipment and connecting piping make changes simple.

Any component or area can be removed and redeveloped with proper continuity to other components or areas. Cost of changes can be estimated easily.

▶ Licensing Plan — To first-time users of the PDQ Technique, Parco offers a fixed price or lump-sum proposal. Should the technique then be adopted for future jobs, a license fee arrangement will be made, based on the total cost of piping material for that portion of the project where the method is applied. Under the license are included know-how, equipment and personnel indoctrination.



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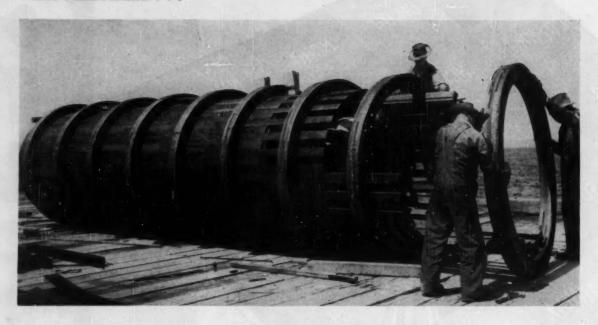
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New Leading Role for Old Standby

Up-to-date preservation techniques—which make it fungi and fire resistant—put wood back into competition with "newer" structural materials.

Can treated wood serve industrial needs? Brooks Lumber Co. thinks it can. A stave pipe like this—made of a patented, butt-locked, pentachlorophenol-treated wood—is part of a 3½-mile pipe-line installed by Brooks at Ketchikan Pulp Co.'s mill in Ward Cove, Ketchikan, Alaska.

But have you considered using treated wood in your operations? Probably not. The American Wood Preservers' Association reports that only 2% of sawn lumber turned out annually (for industrial and domestic consumption) is chemically treated.

The reason: treated wood has already proved itself to be the best material for crossties, switch ties, and poles (preservers treat close to 90% of these items). But it's had a tough time competing with the "newer" structural materials—steel, concrete, synthetics—because people have not been aware of its potentialities.

To remedy this situation, wood preservers are pledged to a two-point program: (1) educating the public on its product's possibilities—it's fungi- and fire-resistant, serviceable, economical and (2) improving on chemicals and techniques currently used in the industry.

That they look to the future with optimism is evidenced by the fact that several companies expanded their facilities in 1954, among them:

 Koppers-acquired 10 plants from American Lumber & Treating Co., unveiled a new treating plant in Horseheads, N. Y.

• Escambia Treating Co.—added pentachlorophenol processing equipment at its Camilla, Ga. plant.

 McCormick & Baxter Creosoting Co.—added Boliden salts processing equipment at its Portland, Ore. plant.

An upswing in the treated wood

market would, no doubt, promote additional expansion. And this, in turn, would increase the production and sales of companies supplying chemicals to the preserving industry.

► As Old As Cheops—Is wood preservation new? As an art, no; as an industry, yes.

The battle against fungi, insects, termites and marine borers—chief offenders in wood deterioration—has been raging for thousands of years. Artifacts unearthed in ancient tombs are proof that the art of wood preservation was practiced by the Egyptians and Phoenicians.

But it was only 80 years agowith the advent of the iron horsethat the art became an industry in the United States. For the railroads, faced with the problem of costly tie replacement, looked to the wood preservers for a solution. And they got one: impregnation of wood with preservatives.

Results were better than hoped for. Creosote impregnation not only cut down the deterioration of the ties, but extended their serviceable life from 15-20 years.

Today railroads are still the wood preserving industry's best customer.

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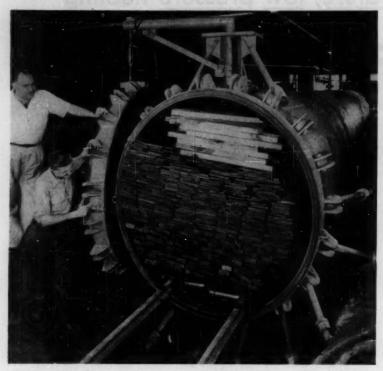
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Dowtherm vaporizer by Foster Wheeler 4,000,000 btu/hr, 650F, 58 psi

FOSTER WHEELER



PRESERVATIVES are forced into the wood under pressures as high as 200 psi.

Better than 48% of the 293 million cubic feet of wood processed annually (in 288 treating plants) goes into ties. And creosote, the oldest and best-known preservative, still accounts for 90% of all wood treated.

Despite their early success, wood preservers soon realized that creosote was not the answer to every problem. Freshly creosoted timber ignites easily and burns readily. Creosote exudes an oily substance on the wood and renders it non-paintable. It has an unpleasant odor and, in some cases, burns the skin.

- ▶ Take Your Pick—In the ensuing search for new preservatives, hundreds of chemicals were tested and discarded. Careful weeding of the field left only a handful which met the specifications set up for a good commercial preservative:
 - · Toxicity.
 - Permanence.
 - · Penetrability.
 - Harmlessness—to wood and metal.
 - Safeness.
 - · Availability.
 - · Economy.

These chemicals are usually classified in one of two main categories—oil-borne or water-borne preservatives.

▶ Pentachlorophenol—Included in the list of oil-borne preservatives are a variety of older creosote formulations and newer ones of toxic chemicals dissolved in lowcost solvent oils. Of the latter, pentachlorophenol solutions seem to be the most promising.

Dow Chemical Co. claims that pentachlorophenol (penta) has many of the attributes lacking in creosote mixtures. It can be used to treat not only the easy-to-penetrate woods (pine, black bum) but the most difficult (douglas fir, white oak).

Penta, says Dow, provides a clean, non-bleeding wood which is paintable—if proper oil solutions are used. And because of its specific chemical composition, penta's concentration can be controlled and determined by analysis.

► Water-Borne—A comparison of preservative solvents shows that water has many points in its favor. It penetrates wood well, is cheap, available and fire-resistant.

But several disadvantages limit the use of water-borne solutions. Water-impregnated wood swells on treatment, requires redrying, then shrinks. Also many water-borne preservatives are subject to leaching. Therefore they can't compete with oil-borne preservatives for outdoor use.

► More Popular—Among the betterknown, non-proprietary, waterborne preservatives, chromated zinc chloride leads the pack in popularity.

Among the proprietary formulations there are several vying for first position, notably:

• Wolman Salts (Tanalith)—
a fluoride-phenol mixture.

Celcure—a solution of chromates and copper salts.

 Chemonite—an ammoniacal solution of copper and arsenic salts, and a relative newcomer,

Boliden Salts—complex chromated zinc arsenate crystals.

Boliden Salts had limited use until last year when McCormick & Baxter (Portland, Ore.) started plugging it. M&B claims that these salts are equal, if not superior to, any other salt treatment on the market. Wood treated with Boliden, it says, is less liable to leaching.

▶ Pressure's Best—Brushing, spraying, dipping, soaking, steeping. These are but a few of the numerous small-scale, non-pressure processes used to impregnate wood. Their effectiveness, however, cannot compare with the more widely used, large-scale pressure processes.

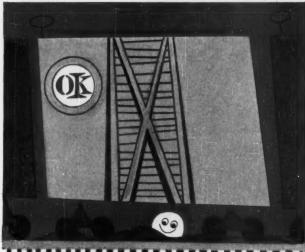
True, pressure treatments are more expensive. But they provide deeper, more uniform penetration and higher absorption of preservative (when required). While pressure methods differ in detail, general handling of material doesn't.

Treatment is carried out in cylinders from 6-9 ft. in diameter and from 35-180 ft. long. Timber is run into the cylinder on special trams riding on steel tracks. Then doors are sealed and preservative is pumped in, pressured to 200 psi. Empty vs. Full-Cell-Empty-cell treatment is usually used to impregnate oil-borne preservatives. In it, the wood is saturated with preservative under pressure. Excess

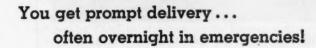
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Alumina • Basic Refractory Brick and Ramming Materials • Dolomite • Magnesia • Magnesite • Periclase

CHEMICAL ENGINEERING-April 1955

preservative is kicked out under partial vacuum, leaving only the cell walls of the wood fibers impregnated.

This technique, requiring less material (but similar equipment) than others, can't be used in waterborne impregnation. Some salt would be removed when excess preservative is kicked out, leaving incompletely protected cells.

Therefore the full-cell process is used. In it, a preliminary vacuum is pulled on seasoned wood, followed by addition of preservative and pressure application. When no more preservative can be forced into the timber, pressure is released and the cylinder drained. ▶ Playing With Fire-Just as the railroads gave impetus to the preserving industry, so the U.S. Navy started the fire-retarding industry on its way. Navy specs-as far back as 1895-required the use of fire-retardant wood in the construction of warships. Following suit, the N. Y. Building Code specified fire-retardant wood for interior finishes in buildings over 12 stories.

Since the early 1900's, however, the industry's had its ups and downs. Government restrictions on building after World War I limited the market for fire-retardant wood. Scarcity of materials during World War II upped demand.

► Cost, a Factor—Cost has played a large part in determining the popularity of certain fire-retardan' chemicals. It's responsible for the limited use of ammonium phosphates, the more common use of zinc chloride, ammonium sulfate, borax and boric acid.

Standards of the American Wood Preservers' Association include four water-borne formulations made up of combinations of these more popular retardants:

- · Chromated zinc chloride.
- Chromated zinc chloride (FR).
- · Minalith.
- Pyresote.

These do a double job. They protect against fire and against fungi and insects. Wood treated with these solutions will char on continuous exposure to fire, but will not spread flames beyond the heated zone. Burning ceases when the heat source is removed.

► Good, But Not Perfect—Though expensive, fire-retarding treatment is prescribed, by law, for most public and office buildings. More and more building officials have called for it to cut down flash fires.

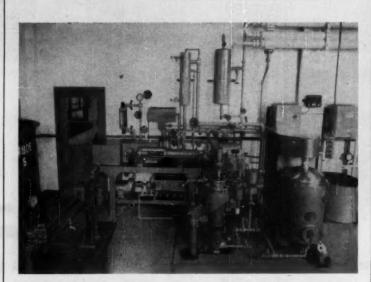
There's just one hitch in using fire-retarding chemicals. Because these compounds are water-soluble, they will leach out of wood exposed to continual moisture. Thus use is confined to indoor work.

The company to come up with an effective, non-leachable retardant has a ready-made market waiting for it.

U. S. Boosting Newsprint Capacity

Continuing the concerted drive to lessen U. S. dependence on Canadian newsprint, International Paper Co. will build a \$20 million mill at Mobile, Ala., site of other company plants. When completed late in 1956 the plant will be able to turn out 100,000 tons of newsprint a year.

Total U. S. newsprint capacity now is 1.3 million tons annually, compared with about 6.1 million tons in Canada. But by 1958 U. S. potential is expected to be at least 25% greater than at present.



Vegetable Oil Research on Commercial Scale

Not content with bench-scale or other small-size research results, Sharples Corp., Philadelphia, recently started running this commercial-scale vegetable oil refinery for research and development. The plant will allow both existing and prospective refiners to determine which of several processes is optimum for their particular needs.

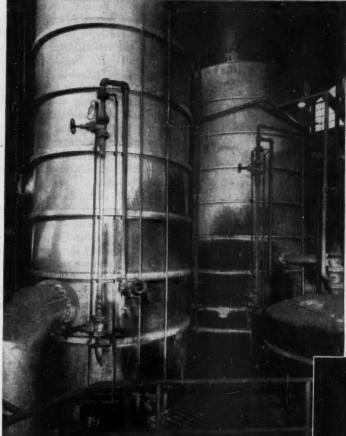
Test results will be directly applicable to commercial refineries for two reasons:

• Plant capacity is a tank car daily (60,000 lb.). Commercial plants are usually a direct multiple of this, commonly four or more in the U.S., three or less elsewhere.

 Crude oil can be processed in the plant by any of five methods caustic, modified caustic, soda ash, modified soda ash, ammonia.

These processes differ mainly in the treating agent used. All are a series of "treats," followed by high-speed centrifugal separation. Sharples' interest in improved processing is obvious when you consider that the company has designed and built 125 vegetable oil refineries in the U. S., compared with less than 20 by all its competitors.

A Chemical Plant Needs...



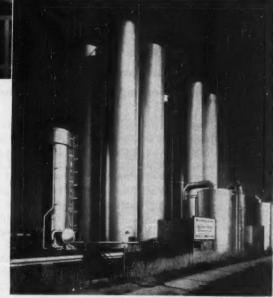
Conkey all nickel construction Triple Effect Evaporators producing 50 per cent caustic liquor.

• Conkey designed and engineered equipment, such as the Conkey all nickel construction Triple Effect Evaporator shown above, is fabricated in Chicago Bridge & Iron Company's four strategically located shops and erected by CB&I experienced crews. Conkey engineers will be happy to assist you with any crystallizing, evaporating or filtering problems your plant may have.

● CB&I designs, fabricates and erects welded steel plate structures of all types. The CO₂ towers shown at the right were erected for the Liquid Carbonic Corporation plant at Belleville, N. J. When you plan processing equipment, pressure storage tanks or flat-bottom storage tanks, write our nearest office.

Filters Evaporators Crystallizers Processing Towers Pressure Vessels Flat Bottom Tanks

... and many other welded steel plate structures, all built to exacting standards. Conkey and CB&I engineers are ready to help solve your problems. Just write your nearest CB&I office for further information, estimates or quotations.

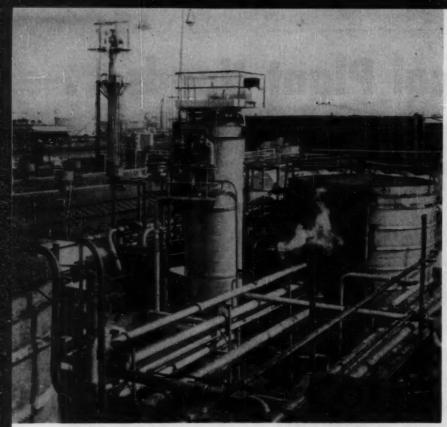


Eight 12-ft. diam. by 100-ft. carbon dioxide towers fabricated and erected by CB&I.

CHICAGO BRIDGE & IRON COMPANY HAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

CONKEY

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City San Francisco • Seattle • Tulsa • Washington



ROTATING DISK contactor in lube-oil refining at Shell Haven, England.

Low Cost, High Efficiency . . .

That's what the new RDC liquid-liquid extraction columns are proving to have in commercial plant operations. New applications are under investigation.

In the short time since its introduction, Shell Development Co.'s rotating-disk contactor for liquidliquid extraction has compiled an impressive record. And stirred up a lot of interest among chemical engineers.

Six commercial RDC units—with tower diameters as large as 7 ft.—are already in operation. Shell companies operate five of them. Four are used in furfural refining of lube oil—at Shell Haven, England; Pernis, Holland (two units); Buenos Aires, Argentina. One is in service at Houston, Tex., on the separation of mixed chlorinated hydrocarbons.

The sixth unit is at the Salzberger refinery at Wintershall A.G. in Germany.

More units are coming. The RDC extractor is now under study by various groups for such jobs as purification of synthetic detergents, removal of phenol from industrial wastes and extraction of mercaptans from gasoline.

▶ Why the Interest?—Let's look at the 2,000-bbl. per day furfural extraction unit at Shell Haven (see cut). Here a 6½-ft.-dia., 24-ft.-high rotating-disk contactor has replaced a 14-stage mixer-settler. Cost of the new contactor is 50% less, holdup only 10% of the mixer-settlers. And mechanical solvent losses are down by 30%.

These impressive results stem from its unconventional design. Most commercial liquid-liquid extractors follow each dispersion stage with a settling stage. But the RDC extractor does away with interstage settling. Degree of dispersion and droplet size are controlled by disk design and shaft speed. No emulsions form and no interstage settling is required. Benefits are many:

• Low H.E.T.S. and high capacities. H.E.T.S. (height equivalent to theoretical stage) is in the range of 1-3 ft.—roughly the same range as the York-Scheibel column, but better than packed towers (5-20) or spray columns (10 20). Relatively unobstructed flow doesn't put the contactor in the spray column class for capacity, but throughputs are roughly 1.5 to 2 times larger than York-Scheibel or packed columns.

Low cost. Low H.E.T.S.
 and high capacity mean low first cost. But maintenance is also low; the shaft, with attached disks, can easily be removed for repairs. And power requirements are low, compared with mixer-settlers.

 Good flexibility. By controlling shaft speeds and solvent ratios you can get a desired separation over a wide range of throughputs.
 Packed columns, on the other hand, are notorious for poor flexibility.

► How It's Built—The contactor consists of a vertical tower fitted with a centrally mounted rotating shaft. Disposed vertically on this shaft is a series of flat, smooth, horizontal disks. Usually shaft speed is below 100 rpm.

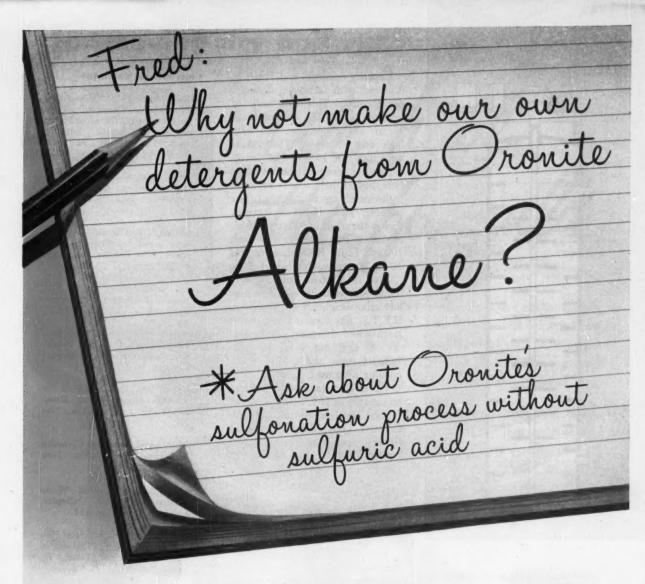
Stator rings attached to the inside wall of the tower midway between adjacent disks form separate "compartments" for liquid-liquid contact.* Terminal separation of the liquids takes place in top and bottom settling sections.

► How It Works—Heavy liquid feeds into the top of the tower; light liquid goes into the bottom. Flow is countercurrent.

The outside diameters of the disks are smaller than the inside diameters of stator rings.

In each compartment there is rotation of the whole liquid mass. And superimposed on this is movement of liquid from the shaft to the wall, and from the wall to the shaft. The flat disks and stator rings create uniform shearing of the dispersed liquid and uniform droplet

^{*} The Shell Haven unit has 20 compartments, each 10 in. high. Diameters: 5 ft. 4 in. for rotor, 4 ft. 5 in. stator. Rotor speed is 25 rpm.



If you are a volume user of surfactants or have plans to market finished detergent products it will pay you to discuss sulfonation with Oronite—the world's largest producer of the basic detergent raw material.

Oronite has a process design which eliminates the acid disposal problem inherent in so many systems. We also have plant designs, to fill any processing requirements, that will produce from one to 10 million pounds or more of finished product annually. You may discover sulfonation less costly than you think.

Contact any Oronite office for engineering and manufacturing data and assistance to accurately estimate your complete needs for sulfonation. It costs you nothing.



OTHER ORONITE SURFACE ACTIVE AGENTS

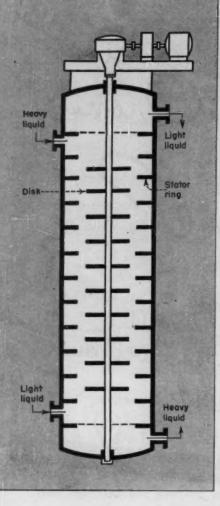
Detergent Slurry • Detergent D-40 • Detergent D-60
Dispersant NI-W • Dispersant NI-O • Wetting Agents



"The world's largest producer of synthetic detergent raw materials"

ORONITE CHEMICAL COMPANY

200 Bush St., San Francisco 20, Calif. • 714 W. Olympic Bivd., Los Angeles 15, Calif. 30 Rockefeller Plaza, New York 20, N.Y. • 20 North Wacker Drive, Chicago 6, Ill. Mercantile Socurities Building, Dallas 1, Texas



size-desirable for good contact and high capacities.

▶ Effect of Operating Variables— Shell Development engineers have tested the contactor on two standard liquid systems* to determine the influence of operating variables. Contactors used ranged in size from 2 to 16 in. diameter.

They found that, on an 8-in. column, capacity decreases with increasing rotor speed, while H.E.T.S. decreases. Throughputs, in these tests, ranged from 440 to 980 gal. per hr. per sq.ft. H.E.T.S. ranged from 0.3 to 1 ft. Speeds were between 310 and 720 rpm. A typical example: for a rotor dia. of 3.1 in. and a stator dia. of 4.9 in., throughput dropped from 980 gal. per hr. per sq. ft. to 440 as speed increased from 520 to 670 rpm., while H.E.T.S. was held constant.

WHAT'S HAPPENING . . .

Capacity decreases and H.E.T.S. decreases with increasing diameter of rotor disks. This is the result of tests on a 16-in.-dia. column, with 12 in. stator openings and 4-in. high compartments. Three disks were used—8, 10 and 11.5 in.

Another result of the investigation showed that capacity increases with increasing diameter of ring opening; while H.E.T.S. increases This is the result of tests on a 16-in. contactor. Two openings were used; 10% and 12 in. Rotor diameter was 10 in., compartment height 4 in.

Also in a 16-in. column, they found that capacity increases with increasing height of compartment. H.E.T.S. was constant for smaller heights and increased for heights of 2.4, 4, 6 and 8 in. Here an 8-in.-dia. rotor, and a 12-in. stator opening were used.

Tower diameter had little effect on capacity or H.E.T.S.

Shell has licensed the Lummus Co. and Turbo-Mixer Division of General American Transportation Corp. to engineer and build RDC extractors.

Reichhold Gets Higher Maleic Anhydride Yield

Using a new catalyst and a modified reaction system developed by Scientific Design Co., New York, Reichhold Chemicals is now getting substantially better yields from its maleic anhydride unit at Elizabeth, N. J. In fact, it's working so well that plans are now in the works to double capacity—to about 5 million lb. a year.

Scientific Design has also just started engineering and designing a new maleic plant near Paris, France, for Compagnie Francaise des Matieres Colorantes, a Kuhlmann subsidiary. Like the Reichhold plant, this unit will include SD's fixed-bed reactor design and the new catalyst.

Main problem in the Reichhold project was that the plant had been running for seven years and represented a considerable investment. Modification had to be made within the existing structure and at minimum additional cost.

Convention Calendar

- "Atomic Energy—the New Industrial Frontier," conference sponsored by Atomic Industrial Forum and Stanford Research Institute, Mark Hopkins Hotel, San Francisco, April 4-5.
- World's Plastic Fair and Trade Exposition, National Guard Armory, Exposition Park, Los Angeles, April 6-10.
- American Oil Chemists' Society, 46th annual meeting, Roosevelt Hotel, New Orleans, La., April 17-20.
- Third National Air Pollution Symposium, Huntington-Sheraton Hotel, Pasadena, Calif., April 18-19.
- American Management Association, 24th National Packaging Exposition, International Amphitheatre, Chicago, April 18-21.
- American Institute of Chemical Engineers, national meeting, Shamrock Hotel, Houston, Tex., May 1.4.
- National Association of Corrosion Engineers, Hotel Statler, New York, May 9-11.
- Tenth Purdue Industrial Waste Conference, Purdue University, Lafayette, Ind., May 9-11.
- American Petroleum Institute, 20th midyear meeting of Division of Refining, Jefferson Hotel, St. Louis, May 9-12.
- Achema XI—Chemical Engineering Exhibition and Congress, Frankfurt am Main, Germany, May 14-22.
- National Materials Handling Exposition, International Amphitheatre, Chicago, May 16-20.
- Chemical Market Research Association, annual meeting, "Outlook for the Chemical Industry," Hotel Plaza, New York, May 18-19.
- American Society for Testing Materials, 3rd annual conference on mass spectrometry, Mark Hopkins Hotel, San Francisco, Calif., May 23-27.
- Chemical Institute of Canada, 38th annual conference, Quebec City, May 30-June 1.
- Fourth World Petroleum Congress, including many technical papers, Congress Building, Rome, Italy, June 6-15.

^{*}Water-methyl isobutyl ketone-acetic acid; water-kerosene-n-butylamine

For moving dry and viscous chemicals-



Allied's Trying to Buy More Natural Gas

If Allied Chemical's Nitrogen Division can increase its firm supply of natural gas in the Midwest, it will go ahead with plans to double capacity of its LaPlatte, Neb., ammonia-urea plant. But if no guarantee of increased, uninterruptible gas supply is forthcoming, expansion won't be feasible.

The firm has asked the Federal Power Commission to allow Northern Natural Gas Co. (present supplier to the LaPlatte unit) to sell Allied an additional 12 million cu. ft. of gas a day on a firm basis. Use of natural gas as a chemical raw material, say Allied spokesmen, is highly economical compared with use for heating.

Current production at LaPlatte is 110,000 tons of urea and 5,000 tons of unconverted ammonia annually. Projected output would be 250-300,000 tons of various nitrogen fertilizers—to be achieved by additional expenditure of \$20 million.

Hydrobon Platformer Goes on Stream

At its Avon, Calif., refinery, Tide Water Associated Oil Co. has started operating a new Hydrobon Platformer capable of turning out 10,000 bpd. of high octane gasoline. This unit is actually a two-step catalytic operation. In the first, sulfur and other impurities are catalytically removed from the charge stock; the second is conven-

tional Platforming, reforming with a platinum catalyst.

Hydrogen sulfide will be a byproduct from the new unit. It will be used to make sulfuric acid at a plant owned jointly by Tide Water and Monsanto adjacent to the Avon refinery.

News Briefs_

Refining: Gulf Oil's Port Arthur, Tex., refinery is getting a new 68,000-bpd. fluid cat cracker and a 100,000-bpd. crude topping and vacuum unit. Old thermal cracking units will be shut down.

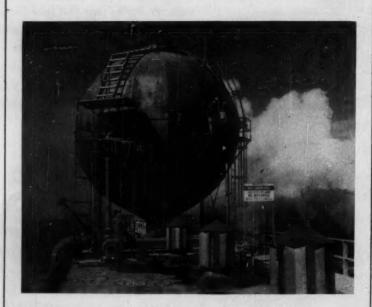
Ammonium Sulfate: San Jacinto Chemical Co. near Houston is now converting part of its ammonia output to ammonium sulfate. And by midyear, Rohm & Haas will start recovering byproduct ammonium sulfate at its Deer Park, Tex., plant.

Chlorine: Weyerhaeuser Timber Co. plans to build an electrolytic cell plant at Longview, Wash. Firm's pulp mills at Longview and Everett, Wash., will use all the chlorine (100 tons a day) and caustic made. Plant design is by R. B. MacMullin Associates, Niagara Falls, N. Y.

Water: Pilot plant tests for desalting sea water by freezing will be conducted this year at the Univ. of Washington under a contract with the Dept. of the Interior. Theoretically, the freezing method of removing salt takes one-sixth the energy of distillation, and cuts corrosion.

Antiknock: Ethyl Corp. will build a tetraethyl lead plant at Sarnia, Ont., the first in Canada to make antiknock compounds.

Mica: Minerals Processing Co., La-Grange, Ga., has made one of the biggest strikes in recent mica mining history. Site is in southwestern corner of North Carolina and facilities are being built to handle 2,500 lb. of block mica daily.

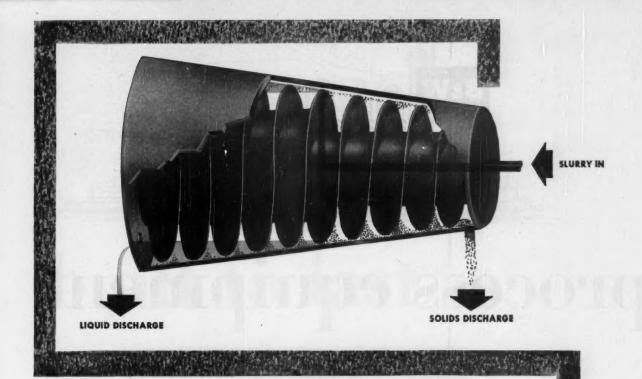


Vaposphere Cuts Kraft Mill Odors

Installation of this vaposphere at Weyerhaeuser Timber Co.'s kraft mill at Everett, Wash., has eliminated the last major odor source from pulp cooking. A 25-ft. steel ball covering a leak-proof plastic diaphragm that traps sulfur gases, the vaposphere has cut by 90% the objectionable odors that remain after off-gases are condensed.

In pulp cooking, sulfur reacts with alcohol and ether in the wood to form small traces of unpleasant sulfur compounds. Hydrogen sulfide can escape during various processing steps.

The vaposphere receives a charge of digester gases about every 45 minutes. These are drawn off slowly and mixed with chlorine.



Continuous Profits from SLURRIES

There are extra profits from slurries when the high-centrifugal-force Sharples Super-D-Canter, with its internal screw conveyor action, separates solids from liquids... whether the solids concentration is as little as 2%, or a thick pumpable sludge... whether the solid particles are ½" in diameter or only a few microns in size.

The Super-D-Canter is doing an industry-wide job on a variety of suspensions—to recover and dewater crystalline type solids, remove amorphous solids, clarify liquids, and classify solids on the basis of particle size. This continuous centrifuge, which automatically compensates for fluctuations in the ratio of solids to liquids has, in many plants, eliminated costly filter operations and attendant labor expense. The Super-D-Canter can be flushed without opening, and may be equipped with a solids rinsing mechanism.

Make continuous slurry handling really pay off. Sharples Bulletin 1254 is yours for the asking.



THE SHARPLES CORPORATION

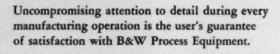
2300 WESTMORELAND STREET - PHILADELPHIA 40, PENNSYLVANIA
NEW YORK- PITTS BURGH - CLEVELAND - DETROIT - CHICAGO - NEW ORLEASE - SEATTLE - LOS ARELLES - SAN FRANCISCO - MOUSTON

Associated Companies and Representatives throughout the World

B&W

advanced manufacturing techniques assure

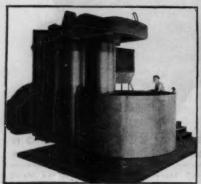
process equipment



Many of the advanced production and testing techniques used, in casting, forming, machining, welding and stress relieving, require specially designed equipment. Much of this equipment was originally developed by B&W.

Intensive research and development, aided by long experience and first-rate facilities, have earned for B&W Process Equipment a fine reputation across the nation and abroad. The Babcock & Wilcox Company, Process Equipment Dept., Barberton, Ohio.

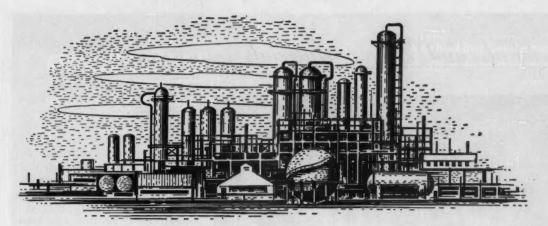




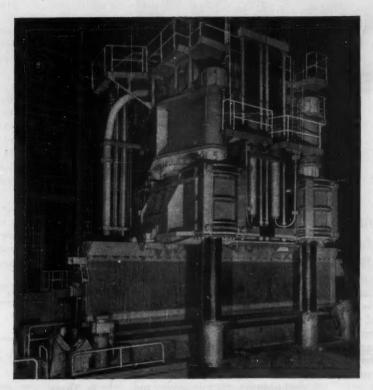




April 1955—CHEMICAL ENGINEERING



built to last



New hydraulic press, installed at B&W's Barberton, Ohio, works, is used to form extra heavy plate and to pierce billets. It is the largest of its kind, and has a capacity of 6500 tons plus.







CHEMICAL ENGINEERING-April 1955

\$-415

Chemicals and Raw Materials Educa by D. R. Cannon



FILM-FORMING AMINES cause drop-wise condensation, reap double bonus:

More Heat, Less Corrosion

A non-wettable organic skin on metal surfaces improves heat transfer and guards against the attack of oxygen and carbon dioxide in steam condensate systems.

As avid consumers of power and process steam, the chemical process industries are much concerned with the problems of efficient heat transfer and corrosion prevention which are ever present in steam condensate systems.

One of the neatest and fastest growing approaches to the solution of some of these problems is the use of volatile, film-forming amines.* Injected continuously into feedwater for low pressure boilers, these compounds vaporize with the steam and deposit a nonwettable, protective film on metal surfaces wherever condensation occurs and throughout the return system as well.

Although primarily designed to shed corrosive attack by oxygen and carbon dioxide dissolved in the steam condensing equipment, amine "raincoats" also increase chances for drop-wise-rather than film-type-condensation . . . and the better heat transfer that goes with it. This plus minimum formation of heat-insulating corrosion products makes for over-all energy and/or equipment savings.

► A Lot of Steam—A leader among the filming amines is Hagafilm, a long chain amine first marketed in 1950 by its manufacturer, Hagan Corp., Pittsburgh 30, Pa.*

Since its debut in 1950 Hagafilm has successfully treated more than 100 billion pounds of steam. In fact, sales have doubled each year until today large and small firms all over the country—in the chemical, textile, pulp and paper, electrical—use Hagafilm. Twenty-five big companies put the amine to work in two or more branch plants—seven of the 25 use it in more than five plants.

In a generous cross section of these firms corrosion rates are down 90% or more and heat transfer is significantly improved.

• At a western fiberboard plant, dryer rolls had to be periodically cleaned of corrosion and oil products to restore heat transfer. Then Hagafilm stepped in. Here's Hagan's report on two years' treatment: heat transfer much improved; dryer rolls have remained clean; trap maintenance nearly eliminated; disappearance of red iron oxide which formally originated in the return system and carried back to the boilers.

 An eastern paper mill benefited when Hagafilm was added to the branch steam line serving the molded pulp department. Record of six months' service: corrosion

^{*}Others: Permacol (octyldeclamine), W. H. and L. D. Betz, Philadelphia; Filmeen, Dearborn Chemical Co., Chi-

	Less Corrosion
Chemicals & plastics	91%
Automobiles	. 87% . 98%
Salt	98%
Steel	72%
Textile	98%
Sulfur	97%
Oil refinery	99%
Fertilizers	85%

^{*} Earliest amines in use—like cyclohexylamine—functioned essentially as acid neutralizers, did not inhibit corrosion via film formation. Their nature was such that they often broke down to form ammonia which in turn played hob with copper and brass equipment. Filming amines have, however, been uniformly successful in copper systems.



In antibiotics: Celite® Filtration assures highest purity

Celite Filtration provides the critical purity required for antibiotics because it removes even the finest suspended solids. A Celite Filter Cake contains more than 2,500,000 filter channels per square inch of surface. The Celite method also provides high production volume because it permits fast flow rates.

Celite powders may be used with any type of conventional filter. The right balance between flow and capacity with degree of purity is easily achieved... first in building up a pre-coat of Celite on the filter medium, then by adding small amounts to the solution to form a continuously fresh filter surface. To meet different requirements, Celite comes in nine standard grades of microscopically controlled particle size. Utmost product uniformity is assured.

Because of its simplicity, flexibility and efficiency, Celite Filtration has become the standard for entire industries. For highest purity in antibiotics, for perfect

clarity in food products, for removing impurities from chemicals, petroleum, and other products . . . Celite offers unequalled advantages.

Whatever filtration problem you face, it will pay you to investigate the Celite Filtration method now. A Johns-Manville Celite Filtration Engineer will gladly discuss your problem. For his services, without obligation, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.



Johns-Manville CELITE FILTER AIDS

Products on these pages this month made news . . .

for the card was sometime.	Page number is also Reader Service code number
Film forming amines foil corrosion140A	Soil fumigant
Silicone rubber is easily fabricated142A	Lube for high pressures and temperatures 148C
Peelable plastic packages142B	Sequestrant for heavy metals148D
Fire without smoke144A	PVC resin can be processed at 330 F148E
Kel-F in elastomer form144B	
Lubrication for life144C	Slip-proof surface148F
Dimethyl Sulfoxide, a new solvent146A	High potency cortical hormones148G
Thin film wire insulation146B	Spray coating for equipment148H
Hotel gets plastic skin146C	Two new alkylanilines148I
Cyclic amines148A	Tank-car maleic anhydride148J

. For more about any item, use Reader Service

problems down 90% in the pulp department. In fact, \$400 worth of Hagafilm* did away with a usual annual \$1,200 loss in process heater coils. Corrosion was at a minimum in the return system, as well—77 and 91% at two points, respectively. And traps needing a cleaning dropped from about four a day to just one a week.

• Hagafilm treatment—begun during the last half of the heating season—helped a midwestern electrical equipment manufacturer as follows: (1) no overtime maintenance for cleaning and tearing apart the equipment, as in the past (2) space heating was more effective (3) all old deposits cleaned out (4) only a little piping needed replacement.

At the end of the second heating season the same plant reported: 4½ cars (about 350 tons) less coal used over a five-month period than during the same period the year before; (2) only six nipples, all installed before Hagafilm, had to be replaced; (3) tests with steel specimens showed a 92% reduction in corrosion; (4) trap maintenance had been negligible.

Hagafilm is supplied in solid form or as a ready-mixed liquid emulsion. 140A

"Controlled reactivity" obviates many specialized compounding techniques.

Silicone rubbers normally depend for their unusual properties on a complex assortment of very specialized compounding and curing knowledge and techniques. Now, a new gum stock, W-96 Silicone Gum, permits simpler fabrication of silicone rubber products. The secret lies in the controlled number of undisclosed reactive groups that have been built into the W-96 molecule to speed cross linking to the cured state without the usual complicated processes.

This easy curing permits filling with carbon blacks—most silicone rubbers contain inorganic fillers—and the handling of compounding sections up to 3-in. thickness.

Finished W-96 rubber has better properties, too: good resistance to high pressure steam and an unusually low compression set (12-20% original deflection Method B, 22 hr. at the extremely high temperature of 350 F.). Furthermore, low compression set is present over a wide range of hardnesses, using conventional fillers and with little sacrifive, at the same time, of tensile strength and elongation.—Linde Air Products Co., New York 17, N. Y.

142A



Peelable Butyrates

Plastic packaging material protects metal parts in transit, can be reused indefinitely.

Cellulose acetate butyrate envelopes—the kind that assume the shape of the product—for protecting precision tools, parts and assemblies during shipment and storage got their start in World War II. They reblossomed during the Korean War—2 million pounds annually—but faded a good deal in popularity in the peacetime economy because they cost more than other protective wrappers, they require an initial investment in melt tanks and compound.

Little by little, though, butyrate plastic for protective packaging is winning back its markets. Con-

Silicone Rubber

^{*} For most jobs, Hagafilm is fed to condensate systems at a rate of two or three pounds (\$2-3) per million pounds of steam.



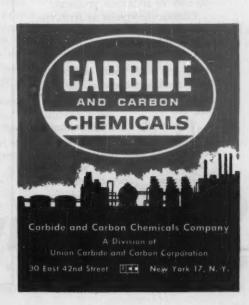
prompt shipment now from 5 plants

. . with another plant under construction

Another ethylene oxide plant using the economical direct oxidation process has been added to Carbide's facilities. With five large plants now producing ethylene oxide by this process, Carbide assures you of a continuous source of supply and rapid delivery. Tank car, carload, and drum quantities of ethylene oxide are available for prompt shipment.

Rely on Carbide for this important chemical building block. Why? Because you can be sure that after 29 years of experience in producing ethylene oxide, Carbide can offer you consistent, high-quality material in the quantity you need—when you need it.

-If you use ethylene oxide, call or write the nearest Carbide office for your copy of "Operating Procedures for Handling Ethylene Oxide." Ask for Form 7618. For information on ethers or other oxides, request Form 4764. In Canada: Carbide Chemicals Company, Division of Union Carbide Canada Limited, Toronto.



sumption today is well over the 750,000 lb. a year mark. Behind this comeback and outweighing the initially higher costs are some solid advantages:

 Stability—resistant to oxidation (they contain rust-inhibiting oils), contain no volatiles.

Positive fusion—secure absolute protection against moisture.

 Transparency — makes for easy identification of marks and codes.

• Easy stripping — butyrates peel like the skin of a grape.

 Reclaimable—protective skin can be remelted and reused indefinitely.

• Simplicity-products are immersed in molten plastic and withdrawn with a tough film, 0.05-0.10 in. thick. Butyrate-coated parts can be shipped in simple containers, usually without other interior packaging.—Eastman Chemical Products, Inc., Kingsport, Tenn.

142B

Fire Without Smoke

Ferrocene promotes nearly smokeless combustion of organic materials.

A highly unique chemical—bis(cyclopentadienyl)iron—seems to have the ability to "clean up" smoke generating processes by increasing the efficiency of fuel combustion to smokeless products.

Commonly known as ferrocene, the product, when added to fuel oils, enabled normally fuming guntype oil burners to yield substantially less soot. And pot burners gave smokeless operation in 12-hr. runs using ferrocene-treated No. 2 oil.

This works for better burner operation from a mechanical point of view, too, since small amounts of ferrocene (0.05% by weight) in heating oils reduce carbon formation on test-burner jets by 40%.

Ferrocene's high degree of stability, low toxicity and a tendency to sublime and distribute uniformly in combustion zones suggest other jobs, as well: improving combustion of jet aircraft fuels; cleaning up auto exhausts; performing as an anti-knock agent.—E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. and Hercules Powder Co., Inc., Wilmington 99, Del.

144A

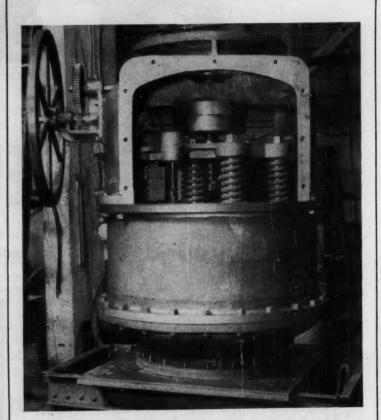
Kel-F Elastomer

New synthetic rubber will soon be on the market.

Kel-F fluorocarbon with all its unusual properties—extreme resistance to oxidants, thermal stability to 400 F., chemical resistance to oils at high temperature—is available in quantity as an elastomer.

Already a number of items have been fabricated of Kel-F-elastomer: hose, tubing, diaphragms, gaskets, tank linings, corrosion resistant paints, acid resistant gloves, boots and protective clothing.

Kel-F elastomer is notable for high tensile strength (2,000-3,000 psi.), good extensibility (400-600%) and good tear strength (150-400 psi.). Compression set values are as low as 5% at 77 F. and 30% at 212 F.—M. W. Kellogg Co., New York 7, N. Y.



Lubrication for Life at 86 psi. and 600 F.

The giant pressure regulator you see above—a Cochrane 24-in. multiport relief valve—must be able to operate at 86 psi. and 600 F. But no mineral oil could lubricate the control mechanism under these conditions. A synthetic lubricant was

called for and—according to testing under simulated operating conditions—found: T/S 25, a lube expected to serve the valve's moving parts for life if need be.—Tri-State Petroleum Co., Philadelphia, Pa.



In the starred area above, construction has started on the new five million dollar plant for the commercial production of the Nitroparaffins and their remarkable family of derivatives. The new plant, the first major step in the company's Nitroparaffin expansion program, is expected to go on stream August 1955.

Located at Sterlington, Louisiana, the new plant is surrounded by CSC's great petrochemical facilities, from which such useful and basic products as methanol, ammonia, and nitric acid flow to all industry. In addition to the new NP plant, existing facilities at Peoria, Illinois, are being expanded.

Virtually laboratory curiosities a few years ago, the

Nitroparaffins have been under study since 1935 in a continuing program of experimental production and evaluation. The four Nitroparaffins and six derivatives, which have already been produced and been proven useful in a wide range of applications, represent only a small fraction of the total number of derivatives under current investigation. The new chemicals represent a unique field of organic chemistry and hold unusual promise for virtually every industry.

The experience of Commercial Solvents
Corporation in evaluating these
versatile chemicals is available
on request to every
manufacturer.

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CSS INDUSTRIAL CHEMICALS

STERLINGTON, LA. . PEORIA, ILL. . TERRE HAUTE, IND. . NEWARK, N. J. . AGNEW, CAL. . HARVEY, LA.

Solvent at the Starting Gate

Eyeing three big markets-acrylics, antifreeze and acetylene-is dimethyl sulfoxide, a new solvent on the threshold of commercial production. Whether DMSO takes the next step depends on a market survey of its potential being conducted by it's booster, Stepan Chemical. Stepan is hopeful, though, that results of the survey will set in motion the proposed building of a 10-million-lb.-per-year plant.

In aspiring to a place in the above fields, dimethyl sulfoxide will be bucking three well established chemicals: dimethyl formamide (DMF), ethylene glycol and acetone. Here's why Stepan thinks

DMSO has a chance.

• Acrylics: DMSO dissolves Orlon as effectively as does DMF, yet costs less (25¢ a lb., based on 10 million lb. a year, compared with DMF at 33¢ a lb.).

- Antifreeze: Infinitely soluble in water, DMSO gives lower freezing point temperatures in aqueous mixtures than equivalent amounts of ethylene glycol. DMSO's specific heat—0.7 cal./g.—is much higher than glycol and other organics. And since its specific gravity is the same as that of glycol, filling station attendants can use the same hydrometers to check radiator mixtures.*
- Acetylene: DMSO dissolves 33% more acetylene than does acetone. Thus, cylinders of welding gas last longer, don't have to be shipped back as soon, and the improved ratio of cylinder to gas volume weight reduces freight charges. Then, too, DMSO's higher vapor pressure minimizes evaporation and the tendency to reduce flame temperatures. DMSO can recover acetylene produced by pyrolysis of hydrocarbons and its selective gas solvency make it useful in the Wulff process for producing acetylene.

Dimethyl sulfoxide's price of 25¢ a lb., although well under DMF's tab, will be a deterrent in competition with ethylene glycol at 15¢ and acetone at 8-10¢. But there's a distinct possibility that its power as a solvent will win enough of a market at 25¢ per lb. to warrant much increased production and an eventual price in the 10-15¢ range.

DMSO will, for instance, dissolve large quantities of ethylene oxide, 60% by weight of sulfur dioxide and 30% by weight of hydrogen chloride and nitrogen dioxide. Solids such as nitrocellulose, cellulose acetate, camphor, resins dissolve in it.

Selective solvency with high capacity for aromatics, unsaturated hydrocarbons and sulfur-containing compounds—with low capacity for paraffinics—could spark a host of end uses: upgrading diesel fuel oils; lube oil refining; separation of unsaturated hydrocarbons from those saturated or less unsaturated; solvent extraction and fractionation of

fatty acids; and deodorization by sulfur-compound removal.—Stepan Chemical Co., Chicago 6. Ill. 146A

Wire Insulation

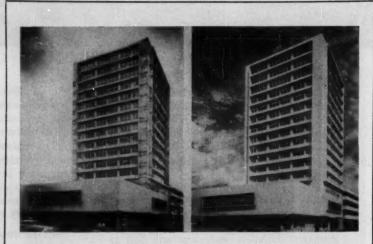
Thin-film organic gives long life protection at 300 F.

Motors operating at 300 F. and more no longer need bulky glass or asbestos wire insulation. Alkanex, a thin-film enamel, appears to provide adequate long-lasting protection at temperatures 75 F. higher than was previously possible with an organic coating.

Low temperatures advantages, too: allowable motor horsepower may be upgraded without increase

in size.

Toughness and abrasion resistance are essential qualities in a motor wire insulation—pulling and flexing put a strain on the insulation. Alkanex—coated wire has been pounded flat without breaking the organic film.—General Electric Co., Pittsfield, Mass. 146B



Hotel in an Envelope

Forty thousand square feet of reinforced concrete encased in a weatherproof, non-combustible, flexible plastic skin, 0.030-0.35-in. thick. That's the Carleton Hotel in Tyler, Tex., after being sprayed with 1,400 gal. of Plastispray, a vinyl sheeting compound. (Above: hotel before and after spraying.) Four sprayers and three helpers did the job in six weeks at a cost of \$16,000, or 40¢ a sq. ft. Considerable savings in construction accrue from the use of this jointless plastic sheeting—rather than conventional brick or aluminum veneer material—to enclose the building. Flashing, parapet coping, facia and calking have been eliminated, too.—Liquid Plastics Corp., Long Island City, N. Y. 146C

One of the reasons propylene glycol never caught on—the expense and bother of another hydrometer.

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Briefs

Several, new carbon-substituted piperazines and pyrazines are in commercial production now: 2-methyl- and 2,5-dimethyl piperazine; 2-methyl- and 2,5-dimethyl pyrazine. These cylic amines have nitrogen atoms in the para position of the ring as well as in the methyl side chains. Existing and potential fields of use: polymers, pharmaceuticals, rubber accelerators and fungicides.—Wyandotte Chemicals Corp., Wyandotte, Mich. 148A

A general purpose soil fumigant called Vapam (field tested two years as N-869) controls nearly all types of soil-borne diseases, nematodes, growing weeds and weed seeds. Vapam is also effective against certain species of soil infesting insects and related pests. Chemically sodium Nemethyl dithiocarbamate, Vapam is highly soluble in water, can be applied easily to the soil.—Stauffer Chemical Co., Mountain View, Calif.

The highest sequestering power for heavy metal ions—ferric iron, nickel, cobalt, copper, etc.—of any chelating agent is the claim for Kalex G. In terms of grams of metal ion sequestered per gram of chelting agent used, Kalex G performs as follows: ferric iron (pH of 7), 0.90; ferric iron (pH of 11), 1.7; nickel, 0.44; copper, 0.52.—Hart Products Corp., New York 18, N. Y.

Polyvinyl chloride resin that can be processed at 315-330 F. is Diamond PVC-45. High bulk density, heat stability, color retention, dry blending and free flowing characteristics round out the high temperature PVC resin's properties.—Diamond Alkali Co., Cleveland 14, Ohio. 148E

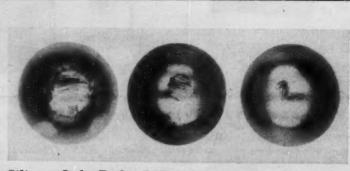
Greater safety from slips and falls and increased traction for foot and wheel are promised by NSC, a slip-proof coating. NSC permanently bonds with concrete, wood, metal, tile or brick, is fast drying, water proof and easily cleaned. Aluminum oxide granules give the coating its traction properties.—Walton-March, Chicago 10, Ill. 148F

Three or four times as potent as cortisone and hydrocortisone in anti-rheumatic activity are meta-cortandralone and metacortandracin. In 15 arthritic cases which had not responded to other drugs, these new hormones produced marked improvements, often in the first day of treatment.—Chas. Pfizer & Co., Inc., Brooklyn, N. Y.; Schering Corp., Bloomfield, N. J.; and Merck & Co., Inc., Rahway, N. J. 148G

Corrosion protection and a moderate degree of insulation are combined in Bitumastic K, a spray coating for metal equipment that doesn't require massive insulation. Made of processed coal tar pitch, mineral filler, solvent and granulated cork, Bitumastic K gives a coating up to ½-in. in thickness with one application.—Koppers Co., Inc., Pittsburgh 19, Pa. 148H

Two new alkylanilines are offered in pilot plant lots as intermediates for the synthesis of petroleum, agricultural and pharmaceutical chemicals, and as precursors for isocyanate and thiourea derivatives. They are alkylaniline C-5, with an average of five carbons in the ring subsituated alkyl group, and alkylaniline C-12, with an alkyl group averaging twelve carbons.—Monsanto Chemical Co., St. Louis 4, Mo. 148I

Maleic anhydride is now being shipped in tank car quantities—8,000 or 10,000 gal.—and at 1¢ a lb. less than the regular price. Advantages of bulk handling now possible with molten chemical: less storage space needed, no small container handling and disposal, more rapid charging, less heating.—Monsanto Chemical Co., St. Louis 4, Mo. 148J



Silicone Lube Defies 107,000 Psi. Bearing Pressures

Each of the three balls pictured above has been immersed in a lubricant, turned at constant speed, and subjected to metal bearing pressures until "seizing," or welding, between parts occurred. A new silicone lubricant permitted the first ball (left) to slide freely at 107,000 psi.—high for a silicone product. By contrast, a synthetic organic diester lube permitted seizure at 27,000 psi. (center

specimen). And a commercial petroleum base jet engine lubricant failed at 14,000 psi. (ball on the right, with the large scar area). The new silicone lube has other outstanding properties, as well: it's passed thermal stability and viscosity tests at temperatures ranging from —65 F. to 500 F.—Westinghouse Electric Corp., Pittsburgh 30, Pa.

148C

WILFLEY ACID PUMPS

INDIVIDUAL ENGINEERING ON EVERY APPLICATION

Typical of Wilfley installations in today's extremely efficient chemical plants, the Wilfley Acid Pump pictured below is a cost-reducing factor of major importance.

Available with pumping parts of machinable alloys as well as plastic to meet every problem in handling corrosives, hot liquids and other difficult solutions. Write, wire or phone for complete details.

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When you specify Chapman Steel Valves you also specify valve steels designed for your specific services. Standard alloys match every normal oil industry requirement. Special alloys can be furnished for extraordinary service conditions. All metals are poured in Chapman's own foundries under rigid laboratory supervision.

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See Chapman first for gates, globes and checks in all pressure classes — 150, 300, 400, 600, 900 and 1500 pounds — and for temperatures from —150°F to 1200°F. Valves are available with bolted or welded body and bonnet joints and with flanged or welding ends. API standards are equalled or exceeded in every range. Write for Catalog No. 20.

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We've been saying

"Eye Accidents Cost More than

\$5.00 Per Worker"



Claimant testified that while at work something blew into his eyes; that a fellow worker wiped the eye with a dirty shirttail; that he suffered considerable pain for several months; that several doctors could do nothing to alleviate his suffering. All of the physicians testified and all varied as to the cause of the injury. One theory was that the claimant was a malingerer; another that the claimant had inflicted the injuries himself; another that acid had come into accidental contact with the eye.

After hearing all the testimony, the court decided that the claimant had become blind in one eye as the result of an accidental industrial injury and

*In compensation alone

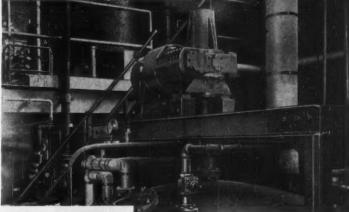
awarded \$24.00 per week compensation for 100 weeks. 98% of industrial eye accidents can be prevented with an adequate Eye Protection Program. It saves eyes. It saves time. It saves litigation. It saves money — in compensation, insurance, idle machines, first aid and in the quality of production turned out. Ask an AO† Safety Representative for details. Or write American Optical Company, 5154 Vision Park, Southbridge, Mass., for booklet.



†T.M. Reg. by American Optical Company

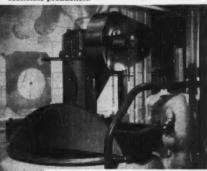
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Briefly, this ad illustrates why DEMPSTER-DUMPSTER SYSTEM

Container at right has cast iron bottom and inside walls are lined with fire brick. It handles hot skim off aluminum.

This Titt Type Container was the result of a cost-cutting idea whereby a high temperature dusty product would be handled by a plant's Dempster-Dumpster. Container has cooling fins, counter-balanced hinged lid with

3-way locking device, 16"

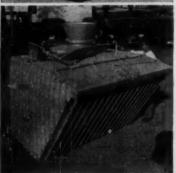
sliding gate valve and two sight-glass inspection

openings.

Here is a Hopper Type Container with a top door for filling and two bottom discharge doors operated by rack and pinion. Another case where the Dempster-Dumpster System was applied to an additional problem to further reduce costs.

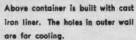
Container at right is just one of several different types we have designed to handle equipment, materials, packages, parcels, etc.











IN A NORMAL INSTALLATION the Dempster-Dumpster System is purchased by a plant because of its proved record for handling bulk materials at tremendous savings. This normal installation usually includes one truck mounted Dempster-Dumpster and any number of standard containers designed to meet the various requirements within the plant. In some cases, containers number 40 to 50. These containers can range in capacity up to 21 cu. yds., with all containers served by the one Dempster-Dumpster.

In the great majority of cases this basic installation is just a starter. Management men, constantly looking for lower operating costs, find numerous and amazing extra savings in the Dempster-Dumpster System. Once in service, transporting developments of every description come to light that supplement the original functions of the equipment. Your own men find easier, quicker and additional cost saving ideas for its use. Many even overshadow the original savings and the equipment becomes more and more indispensable.

Look over just a few of the "Special" containers illustrated in this ad. They are all the result of rough ideas that originated with the men in plants after a basic installation, then developed by our engineers. All ideas were stimulated by the powerful Dempster-Dumpster and its flexibility in picking up, hauling, setting down or dumping anything that needs transporting, at lower cost.

One man, the driver, and a few simple hydraulic controls in the cab of a Dempster-Dumpster, will become indispensable in your plant. It is just that in hundreds of plants of every description throughout the nation. Let one of our representatives give you details of installations. Manufactured exclusively by Dempster Brothers, Inc.





Here is one of several special drop bottom type containers equipped with couplers and ball bearing trucks for operation in train on rails.







This is a special adaptation whereby waste zinc slurry is pumped into two containers, which serve as settling tanks, enabling majority of the water to be decanted before sludge is transported and dumped at waste basin.



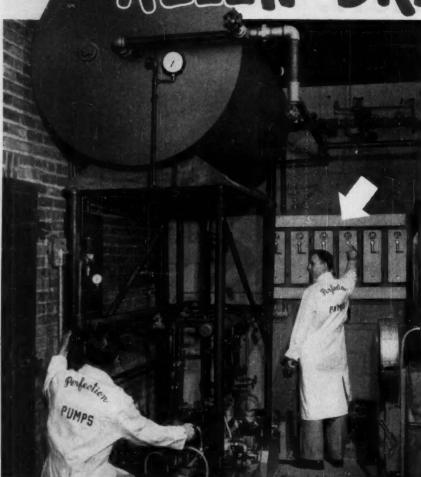
Tank Type Containers are available with or without casters in steel, aluminum, stainless steel, etc. Capacity ranges up to 1,200 gal. They may be lined with rubber, lead, highly resistance coatings, etc.



This is a master container with three 2 cu. yd. insert containers. Each insert container is provided with casters, counter-balanced spring-hinged lid for loading and dumping.

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Six Perfection motor-driven pumps in centralized vacuum storage system for making TV color screens, equipped with Allen-Bradley Bulletin 712 combination starters which have manually operated disconnects.

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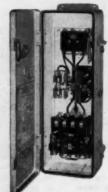


Bulletin 609 Manual Starter in NEMA 4 Watertight Enclosure.



Butletin 709 Automatic Starter in NEMA 7 Explosion-proof, Cast-iron Enclosure.

156



Bulletin 712 Automatic Combination Starter in a NEMA Type 12 Enclosure for protection against dirt and oil.

When you install Allen-Bradley combination starters, you automatically satisfy the Electrical Safety Code . . . because the disconnect switch that is required ahead of the motor starter is mounted with the starter in one enclosure. In fact, these starters give you an "extra" in safety, because the cabinet cover cannot be opened unless the disconnect lever is in the OFF position. Starter and fuses are then "dead" and are safe to inspect. There are two solder pot relays which give continuously dependable overload protection.

Bulletin 713 combination starters have circuit breakers instead of manual disconnects. Both types of combination starters are available in a wide variety of enclosures, so that every service condition can be satisfied. Write for Bulletin 712-713.

Allen-Bradley Co., 1337 S. First St., Milwaukee 4, Wis. In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY

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CHEMICAL ENGINEERING—April 1955

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Chemical Manufacturing Division P. O. Box 469, Jersey City 3, N. J.

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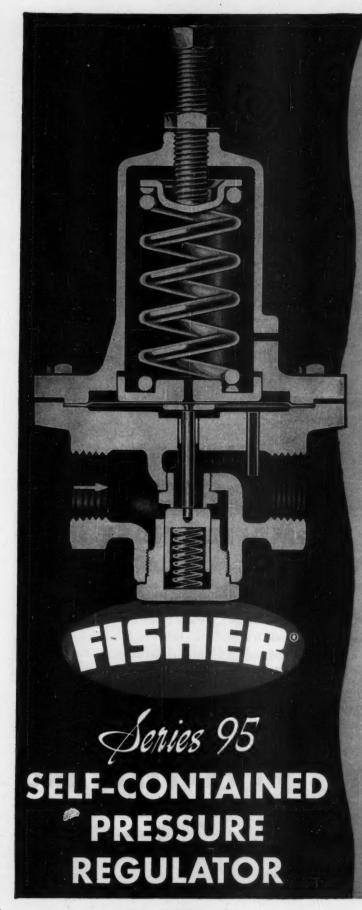
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... A simple, sturdy, self-contained regulator that is suitable for steam, air, gas, oil, water and other fluids.

TYPE 95H features hardened stainless steel trim...flat seat ... machine lapped seating surfaces for tight shut-off for high pressure, high temperature service.

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PSI; 15 to 150 PSI. Size for size, compare its capacity.

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HOW TO BUY RUBBER HOSE

FOR LONG LIFE IN ROUGH SERVICE

... and get
"More Use per Dollar"

Look for a hose construction that is easy to handle, yet strong enough to stand up under tough operating conditions.

It is not necessary for hose to be thick and stiff and heavy. It can be light in weight and still withstand hard use on the job. The lighter the weight, the easier the hose is to handle . . . the better men will like to work with it with less fatigue. Be sure, too, that the hose you buy is the most flexible for the type or diameter you need. If it coils and uncoils easily it is not only easier to handle, there is less internal stress . . . and no kinking, breaking or separation of cover, tube or plies.

If the hose does not kink, it will last longer and you'll get full flow at all times . . . even though it is dragged over rough terrain.

Specify by name the hose construction that combines light weight, flexibility and non-kinking characteristics with maximum safety . . . specify Raybestos-Manhattan Homoflex Hose,



HOMOFLEX HOSE

This is an exclusive R/M construction made in types for handling air, water, gases and other general uses. It has a homogeneous, inseparable tube-to-cover bond. It's as flexible as a rope, light and easy to handle, yet strong enough for the toughest jobs. It maintains uniform inside and outside diameters for

easy coupling. . . . Homoflex Hose reduces hose costs by increasing hose life . . . and it's only one of many types an R/M representative can help you select for both general and special purposes. Let him show you why R/M Hose lasts much longer . . . gives you "More Use per Dollar".

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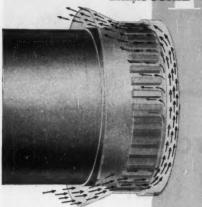
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Other R/M products include: Industrial Rubber - Fan Belts - Radiator Hose - Brake Linings - Brake Blocks - Clutch Facings
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Two Ways

You Can Reduce Operating Costs on Rotary Kilns...

Install an Air-Cooled Kiln End

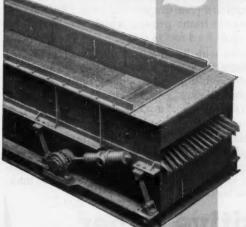


No improvement you can make can cut your costs so much! Operating records show that an Air-Cooled discharge end will pay for itself in 2 to 3 years in refractory savings alone.

An Air-Cooled end circulates cooling air around the outside of discharge end and on underside of nose brick. Your kiln end stays cool, round and rigid - no warpage or end distortion.

You eliminate shutdowns required to replace end brick . . . gain valuable production time. Big fuel savings too - because Air-Cooled kiln end permits the use of a positive seal between firing hood and kiln.

and an Air-Quenching Cooler



Save on fuel costs! Save on installation costs! Save on power, maintenance and clinker grind-

Air-Quenching cooler captures hottest air from cooling clinker at feed end. Movable baffle in the housing directs this hot secondary air directly to kiln. Clinker is cooled by a direct up-blast of cooling air. Fuel costs are sharply reduced.

Be sure to get your copy of new cooler bulletin, 07B7869. It shows how to figure how much an Air-Quenching cooler will save for you. Get it from the A-C representative in your area or write Allis-Chalmers, Milwaukee 1, Wisconsin.

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cents a square foot, Autopositive produces positive photographic prints directly from the original drawings -

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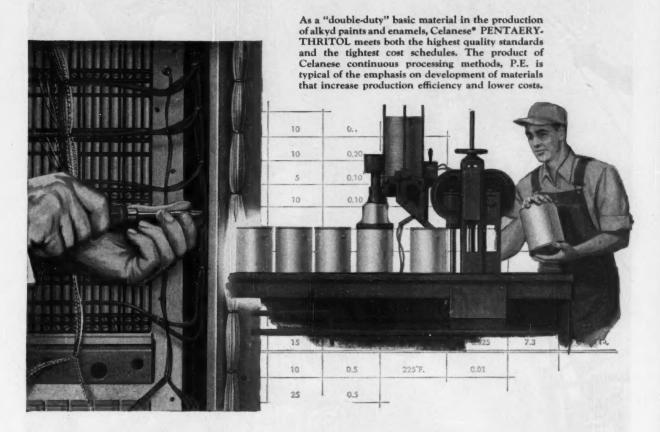
In addition, A. O. Smith keeps an "Autopositive File" showing the history of changes in all their drawings. Before each revision, an Autopositive intermediate is made. Later on, direct-process prints showing the complete story of each design can be made from the intermediates as needed.

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"How can chemical raw materials cut our production costs and contribute to improved products?" Celanese has answered that question many times.

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Celanese Technical Service can work with your research and engineering groups in making organic chemicals work better for you. Ask us to show you how.

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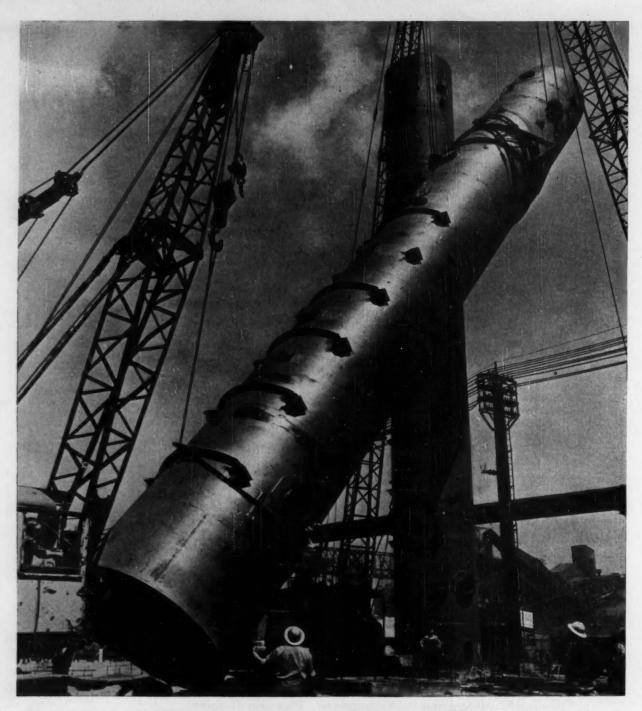
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The big tower shown being eased into position is one of three fabricated at our Bethlehem, Pa., weldment shop for installation at a coke works in Maryland. It's of all-welded construction, with 3%-in. walls, stands 97 ft high and tips the scales at 33½ tons.

The function of the tower is to re-

move 90 to 95 pct of the sulphur and cyanide in coke-oven gas, leaving an efficient, low-cost gaseous fuel with only about one-third the sulphur content of industrial fuel oil.

Perhaps you have need for an absorber tower, a fractionating tower, or other welded vessels for chemical or petroleum processing. Try Bethlehem! Our well-equipped fabricating works at Bethlehem and Steelton, Pa., and Beaumont, Texas, are strategically located to fill your requirements. We suggest you contact the Bethlehem sales office nearest you for further information about welded processing vessels.

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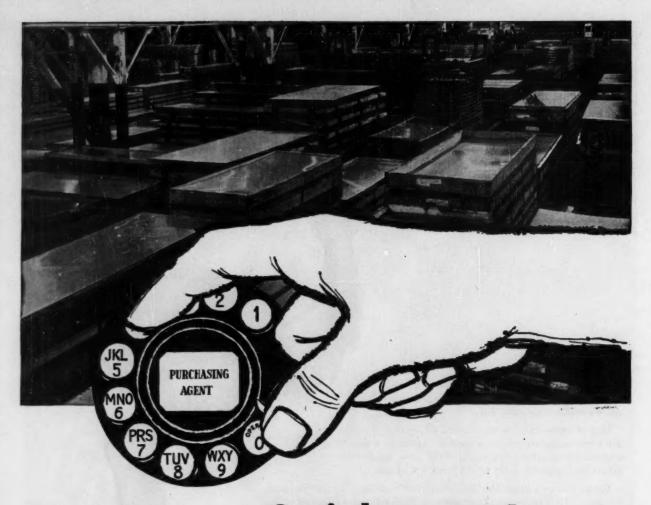
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JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK . BOSTON . PHILADELPHIA . CHARLOTTE, N. C. . CINCINNATI . CLEVELAND DETROIT . PITTSBURGH . BUFFALO . CHICAGO . MILWAUKEE . ST. LOUIS . LOS ANGELES . SAN FRANCISCO . SPOKANE . SEATTLE What Every Chemical Engineer Should Know About . . .

Chemical Unions and Their Aims

This is a vital year for chemical unions. New mergers and pacts make them stronger than ever. Fresh thinking gives them new goals.

How Union Aims Will Affect . . .

You: Their new strength and determination puts them in a position to further cut the pay difference between you and all other chemical engineers and the average worker.

Production Engineers: More headaches are ahead as production costs climb and as human relations begins to play an even more demanding role.

Maintenance Engineers: They'll be in the same boat as production as labor costs ascend.

Design Engineers: Management will turn to designers to cut production costs by supplanting the human element with better and more extensive control devices.

Process Engineers: Shortcuts and alternates will have to be sought to keep costs down.

Development Engineers: Higher and higher labor costs will have to be considered as never before.

especially the "hidden" costs of fringe benefits — will take a bigger part of your estimates.

HUGH T. SHARP

1955 is rapidly shaping up as a year of substantial change for most of organized labor. Chemical and oil unions have taken the lead in some of these changes, as old rivalries and former alliances are shifting and even bargaining patterns are being revamped.

Engineers should have some idea of what's going on, and as more and more chemical engineers move into manuagement, knowledge of the aims of these unions becomes especially important.

Unfortunately, the average chemical engineer has few opportunities to take an over-all look at the unions which deal with the oil and the chemical industries. Hundreds of such unions are active in these industries—representing workers ranging from file clerks to pipefitters.

Here, we'll discuss some of the current developments in chemical labor and the operations and aims of three of the largest of the operators' unions, the newly formed Oil, Chemical and Atomic Workers International Union (CIO), the newly renovated International Chemical Workers Union (AFL) and the ubiquitous District 50 of the United Mine Workers.

Oil-Chemical Merger Leads Way

Recent formation of the OCAW from two prior CIO unions, the Oil Workers International and the United Gas, Coke & Chemical Workers, promises to heighten union activity in the chemical and the oil industries.

Increased organizing efforts, more effective union bargaining machinery, elimination of jurisdictional problems (which were becoming rather ticklish in many petrochemical plants) and a concerted push to gain more worker benefits—mainly for chemical men—are expected results.

The joining of the Oil Workers and Gas-Coke may be only a precurser of future combinations—featured by the soon-to-come blending of the AFL and CIO.

Despite the intricate problems in view, such as the enforcing of "no raiding" pacts, the two giant groups are well on the way to joining forces. They've set the end

Hugh Sharp, a chemical engineering graduate of Villanova, edits CE's You & Your Job department. Here he gives you a look at current chemical union aims and actions.

"We won't be really strong until we organize Du Pont-and we intend to be strong."

of this year as the target date for organic unity. If all goes as planned, organized labor will soon boast a loosely confederated alliance of some 15 million members.

Individual unions will continue to retain their autonomous bargaining programs, but the new over-all body will provide moral support and give volume to labor's voice on legislative and other matters. It should also spur a merger between CIO and AFL chemical unions.

In Unity, Strength-and Money

For a while, anyway, AFL-CIO unity shouldn't have too great an effect on the chemical union picture—except, of course, to eliminate jurisdictional feuds. Formation of OCAW, on the other hand, touches the chemical industry on several fronts.

According to O. A. (Jack) Knight, OCAW president, the merger heralds no sudden or drastic changes in bargaining. Union locals will continue to bear the brunt of the negotiations on a plant-by-plant basis. But the union strongly favors company-wide talks on those items which management determines at the upper levels, such as pensions, saving plans, etc., and which generally apply throughout the company. Unlike some union leaders, Knight does not ask industry-wide negotiations, as in steel and autos.

Although Knight also says that there will be no attempt to achieve stereotype contracts, you can look for the somewhat lower paid chemical workers to cite oil worker pacts in bargaining and, where advantageous, vice versa.

Which Way, How Far

To learn what demands to expect from the new union, it's worthwhile to glance at the goals set by the individual groups before merger. Since the oil union should prove the power in the new union, we'll check theirs first.

Even before merger, OWIU was starting to talk tough about its demands. In June 1954, the oil men voluntarily adopted a "no strike" pledge to end management complaints about "bringing a loaded gun to the conference table." They dropped the pledge when the next five months of bargaining brought no wage boosts. And took a more militant stand.

The oil workers set as their top goal a general wage increase of 5% or its equivalent in fringe benefits. The chemical union, though not satisfied with the prevailing pattern of 5¢/hr. boosts, did not have so ambitious an aim. Now it's likely that the chemical locals in the new union will up their demands.

Even before merger, Gas-Coke was planning to prepare figures on cost per unit of production and net profit per man-hour worked for the use-along with company financial statements-of the locals. This is to be done so "the

companies will no longer be able to bluff us at the bargaining table."

Everybody's a Target for Organizers

Probably the biggest factor bringing the recent merger home of chemical and oil industry engineers and executives will be greatly stepped up organizing activity.

The oil workers have long pursued the many independent unions in the oil industry, and as recently as a year ago they pushed a unification drive among the independents. This failed but with new strength a renewed drive will be launched.

OCAW's first objective is the employee union of Standard Oil Co. (Ind.), whose Whiting, Ind., plant they consider a fertile field for raiding. Next come the other independents, especially those at Standard Oil (N. J.), Gulf, Shell and Tide Water.

On the chemical side, the primary objective is Du Pont. Just as the steelworkers didn't get far until they organized U. S. Steel and the auto workers had to organize General Motors before they could hope to attain real strength, so the chemical unions realize that until they are "in" at Du Pont they will remain relatively weak.

The merger, they hope, gives them the money and the personnel to do the job. Knight lists this as a major aim. Elwood Swisher, former president of Gas-Coke heartily agrees, as does CIO President Walter Reuther, who's backed the drive by opening his auto union's treasury OCAW.

Though Du Pont is the prime target, Knight makes it clear that no employer of chemical or oil workers is exempt from his union's organizing efforts.

Atomic energy installations might also be included in that. Gas-Coke represented workers at all three gaseous diffusion plants and it was none too happy with the treatment it got from either plant management or the government. One result of last year's strike at Oak Ridge was a promise by Secretary of Labor Mitchell to launch a study on collective bargaining in atomic plants.

Long Range Aims Follow Pattern

Over and above the immediate goals, more members and more money, lie some important long range aims—all of which augur another hike in chemical production costs.

Chemical unions—much smaller and less tightly knit than steel or auto workers—generally follow the lead of the bigger unions. When any of the stronger, bigger, pacesetter groups gains a demand it almost automatically becomes a goal for the smaller unions.

This year, as usual, the bigger unions have come up with dozens of points but those watched with greatest interest by the oil and chemical workers are:

• Guaranteed Annual Wage—Recently rechristened the Guaranteed Employment Plan, this is THE goal of several unions in '55. The United Auto Workers are committed to press for it, and with GM and Ford battling bitterly for sales a big strike would hurt. So there's a chance that UAW will win out. GAW (or GEP) forces the company to equalize its production schedules by requiring a penalty payment of wages to laid off workers.

Companies either provide work or pay. Some oil and chemical union leaders, as well as most management men, feel that the question of GAW is academic in these industries since they have little seasonal or spasmodic employment. But the union men quickly point out that if they see a need for it they'll go after it.

• Automation—Integration and automatic control of production figures as much in the unions' plans as it does in managements'. Generally, the chemical and oil unions favor it. But, again following the big union's lead, they want a "fair reward" for the worker from the fruits of automated production. They argue that greater buying power for the worker is a must to create the market for the outpourings of the automated production.

• Shorter Work Week—In the view of several union leaders, this will climb to the top of their list "as soon as GAW is won." Automation, they feel makes it possible—even desirable—to again cut the work week. A 30-hr. week is the aim. A 35-hr. week is counted on as the first step.

• Pensions—Union leaders look at pensions as the foremost of the fringe benefits. In the chemical industry they're pushing for noncontributory pensions at higher rates and with rights vested in the individual worker. This enables a man to retain his pension rights even though he transfers to another chemical company. Significantly, the unions approach this with economic arguments, proporting to show how such plans actually save company money as well as aid in attracting and holding better and better satisfied workers.

Pressing for "Deferred Wages"

By and large these are the aims of the other big chemical worker unions, too. For instance, better pensions rank with wage hikes at the top of the AFL's International Chemical Workers' list of demands.

IGWU's new president, E. R. Moffett, and its economist and research director, Otto Pragan, regard pensions as a form of "deferred wages"—an integral part of the worker's pay—and they've urged their locals to bend every effort to make them more attractive.

From the "deferred wages" stand, the union leaders argue that pensions should be entirely noncontributory, provide some flexibility as to retirement age, be independent of social security benefits and vested completely in the worker if he transfers to another company ("He has a right to receive what's been set aside for him.").

Inside Troubles End, Outside Worries Grow

Though ICWU's top posts have recently changed hands, no drastic changes in operation are expected—locals will still enjoy a good deal of autonomy. However, the internal troubles which resulted in 1955's overthrow of the prior administration did leave wounds which are only starting to heal.

These top level shifts are likely to leave an imprint on bargaining tactics. The previous administration was often accused of being too weak and meek in negotiations. And a reaction to this may show up in a tougher union attitude in future talks. Especially since the union plans to boost its wage demands substantially.

"Certain companies have bluffed us for years. We know they have the dough, we won't be bluffed again."

But since ICWU prides itself on both its friendship for chemical companies that employ its members and its faithful adherence to contracts, this toughness will probably mean more skill and facts—and not just plain obstinacy —at the bargaining table.

For instance, ICWU now conducts seven one-week schools for negotiators to help them handle their end of the bargaining. And its Research and Education Dept. literally bombards the locals with bargaining information, and takes an active hand in training local leaders in the strategy and tactics of collective bargaining.

As important as the internal rivalries have been, feuding with the other chemical worker unions has probably been a bigger drain on ICWU's resources. Despite "no raiding" agreements and the excellent prospects of AFL-CIO unity, ICWU President Moffett is chary about peace prospects.

The oil workers-chemical workers merger and Jack Knight's ambitious organizing plans don't help him sleep any easier. Merger with Knight's group may result.

Claims Most Chemical Workers

One union professes not to be concerned with the merger or any of its aftereffects. That's sprawling—and sometimes brawling—District 50 of John L. Lewis' United Mine Workers.

John L.'s younger brother, A. D. (Denny) Lewis, holds the top administrative post in District 50, the union which claims the largest membership of chemical industry employees, some 100,000.

District 50 steers a sternly independent course through the cross-currents on the labor scene. To some extent it mirrors John L's own personality—though its history has not been nearly as turbulent. And it's Lewis' personality and "look at all he did for the coal miners" that are the UMW's biggest magnets in membership drives.

District 50 feels that this and its own list of accomplishments are such that the merger will have no effect on it or its organizing activities. Other observers say that further and more intensive membership raids are in view.

Locals Are Largely Independent

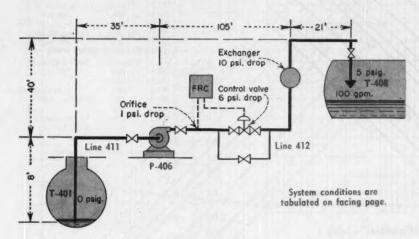
District 50 was formed to provide a home for locals, particularly coke, utility and chemical locals, which preferred to become a part of the United Mine Workers rather than separate unions in the CIO.

Locals have an exremely wide latitude in running their own affairs. District 50 doesn't even hold a convention. It does not stress over-all aims. Rather the emphasis is on giving each local the opportunity and the incentive to bargain for what it considers the best deal. Generally, separate contracts are negotiated for each plant.

Cut Pump Specification Work With

Pump no.		Sch. & pipe	& pipe matl. 40	Stee!	Vis	-	A	cb
		Temp., max.	40	lin.	F. Kin	P20 03		
Design gpm. / 00 Reference drawings:		From Z-	Vol To	1-400	Vap	Vapor press. C m	@ max. P.T. 7.00	milig(VP
,		Suct	Suction Line			Disc	Discharge Line	
Line no.	7	21. (12.49)	\$11/4 118	11/4/03)	7	2 (2.07)	21, (2.49)	3 (3.07)
une size, inches I. D. Velocity, ft. sec.	0 >	6.70	4.34	30	4 0	9.56	6.70	4.34
Frict. loss, ft. fluid/100 ft.	E4 2	155,000	125,000	96.000	F N	185,000	155,000	125,000
Lineal feet of pipe	DIL.		430	1	1	166	1	99/
Gate valves	40	77-57	77-77	2,3 2,3	4	1-4.0	1.5 -6.0	2,0
Globe valves	00	6-12.0	8-16.0	11 22.0	9.0	6 12.0	-	8 16.0
Tees, thru branch	-	-		-	10	12 - 120	14-14:0	17 - 17.0
lees, taru run					90			
	90				90			
Notal Equivalent Length	EL	56.5	60.7	67.3	瓦	201.0	208.0	217.0
Line frict., (FxEL/100)1.15	(St.)	- 4.5	977 -	5'0 -	Fd	+ 38.6	7.91 +	4 5.0
Vessel pres, psig. x 2.31/3G	Ps.	1-80	1 - 8.0	1 - 8:0	Pd.	4/0.0	40.0	40.00
Tank contr. or enl. loss	ns.	400	100-	- negl.	2 4	+ neg/.	, negl.	, peg/.
Orifice pl., psi. x 2.31/3G	,			J	150	+ 2.7	+ 27	1.2.7
Contr. valve, psi. x 2.31/8G		7			300	27.04	27.0	+ 27.0
								-
Alg. sum = suct. or disch. head	Ha	-12.9	-9.7	5:3-	H	+ 139.0	+ 1/6.1	+ 105.2
Total Dynamic Head, Hd-Hg	TOH	125.8ft. (3	" suct., 2%	/wdisch.)	Form		1	
Abs. pressure head Ps ** + 34/SG	/36	4 30.0	4 39.0	000		psi. = (2.31/SG) = .408 gpm./d ² = /enm.	23 - 6. L ft. fluid	fluid
ad head head .045 x VI	+ Fs	21.0	- 21.0	21.0	4	E		
Alg. sum = NFSH, ft. fluid		+ 5.9	+ 9.1	+ 10,3	24	= V2/128.8		
"Minus for suction lift. **Minus for pressure less	for b		than atmospheric	ic.	No	1	× SG	

Standard Data Sheet



SAMUEL R. COX

In plant design you can facilitate the specification of numerous centrifugal pumps by using a standardized data sheet to calculate total dynamic head and NPSH data. Such a sheet should combine conciseness with simplicity, completeness, orderly arrangement and ease of reference.

On the opposite page you see a pump sheet filled in with data and evaluation of the pump characteristics required for the piping 'system diagrammed above.

Listing Data

Pumping rate, pipe data and physical properties of the fluid to be pumped are entered in the top section of the sheet. In the center columns under Suction Line and Discharge Line you enter the preliminary suction and discharge line sizes. These usually are sized arbitrarily on some basis such as fluid velocity, approximate unit pressure drop, etc.

The next larger and smaller standard pipe sizes are entered in the adjoining columns. Friction loss F (ft. of fluid head per 100 ft. of pipe) for each pipe size then is calculated by whichever standard method you prefer.

SAMUEL Cox is a process engineer with United Engineers & Constructors, Inc., Philadelphia, Pa. Re-publication rights are retained by author.

From the piping diagram the lineal feet of pipe and the quantities of each fitting are entered in the indicated section of the sheet. Space is allowed for entry of fittings not specifically tabulated. When the equivalent length of each fitting is recorded for each pipe size, the total equivalent length EL of each size of suction and discharge line is determined.

For each size of pipe the friction loss F multiplied by the equivalent length EL divided by 100 yields the suction-piping friction drop F_{\bullet} or the discharge-piping friction drop F_{\bullet} in feet head of fluid. The 1.15 constant reflects a 15% addition to the friction drop to compensate for variation in the equivalent length of similar valves and fittings made by different manufacturers.

To the line friction losses F_{\bullet} and F_{\bullet} for each size of pipe are added algebraically, in accordance with the tabulated plus or minus signs, the fluid head equivalents of equipment and static conditions remaining constant despite changes in line size. Included are vessel pressure, suction static head, discharge static head, heat exchangers, control valves, etc. (See system diagram above).

Although entry space is allowed for the contraction loss h, at the feed tank, this pressure drop often may be considered negligible at normal suction-line velocities. Exceptions: when

the tank outlet is smaller than the suction line, or when the contraction loss decreases the available NPSH to an unacceptable figure.

In like manner, the enlargement loss h, may be ignored unless the liquid pumped is discharged under the surface of the liquid in the receiving tank.

Determining Head Conditions

The algebraic sum of each column becomes the total suction head H_{\bullet} or the total discharge head H_{\bullet} for each line size. You now must calculate available Net Positive Suction Head, NPSH, which may be defined as the difference between those factors that hinder and those that promote vapor flashing at the pump inlet.

Hindering factors are the absolute pressure in the tank from which the pump draws and the static head from the lowest liquid level in the tank to the center line of pump inlet (1st stage inlet of vertical pumps). Promoting factors are suction lift, line friction, contraction loss, and the absolute vapor pressure of the liquid pumped.

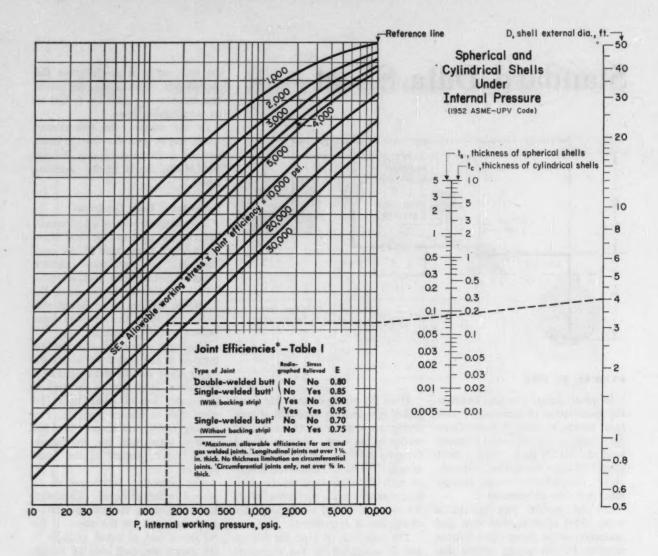
The preceding factors are all expressed in feet of liquid. Their algebraic sum, using the plus and minus signs indicated on the sheet, is the NPSH in feet of liquid available to the pump for each size of suction line. Usually it is advisable to select a pump whose NPSH requirement is at least 10% less than NPSH available, to preclude cavitation of the pump.

In this example, a 3-in. suction line was selected to make available sufficient NPSH for the type of pump under consideration. The discharge line was selected on an economic basis. Annual charges for power, amortization of installed cost, were found to be lowest for the 2½-in. size pipeline.

Total dynamic head becomes H_4 — H_s =116.1-(-9.7)=125.8 ft. This would be rounded off to a design TDH of 130 ft.

In the lower right hand corner of the chart are formulas that are useful in pump head calculations.

Single copies of a blank standard data sheet are available without charge. Just check No. 60 on your Reader Service postcard.



Charts for Pressure Vessel Design

Here are four new nomographs. They offer a quick way of getting shell or head thicknesses for cylindrical and spherical pressure vessels.

C. J. MAJOR

Proper design of pressure vessels depends on many details—head shape, safety valves, size of openings—but none is singly as important as thickness.

The 1952 ASME Code for Unfired Pressure Vessels provides the means for calculating thickness for various shapes and sizes of vessels.

However, in some cases the calculations can be tedious and involved. Particularly where equations are complicated, or where the calculation may involve trial-and-error. Nomographs can be very useful in these situations.

We have developed nomographs for four major categories covered under the code: (a) cylindrical and spherical metal shells under internal pressure, (b) spherically dished and hemispherical heads under internal pressure, (c) cylindrical steel shells for vacuum service, and (d) steel dished heads and steel spherical shells under a vacuum condition.

These nomographs offer a convenient method for quickly determining thickness; or if the thickness is known—maximum allowable pressure required under actual working conditions.

Pressure Service

Cylindrical Shells

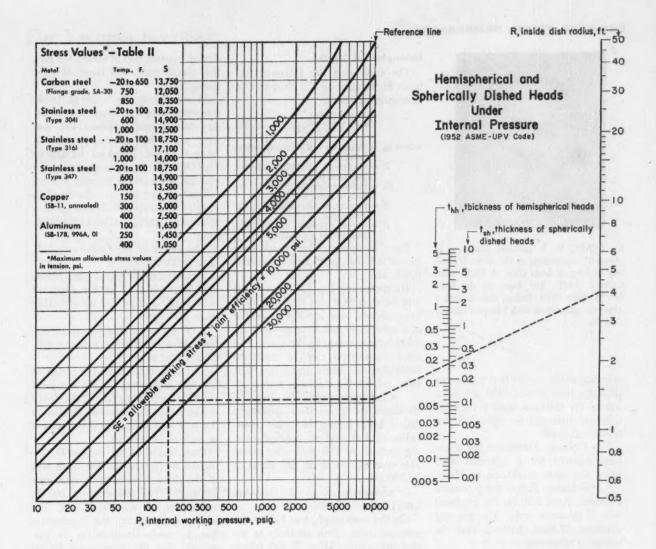
The 1952 ASME Code for Unfired Pressure Vessels gives this formula for the thickness of cylindrical shells under internal pressure:

$$t_o = \frac{PR_o}{SE + 0.4P} \tag{1}$$

where t_{τ} = thickness of cylindrical shell, in. $P = \underset{\text{pressure paig}}{\text{maximum}} \text{ allowable internal}$

pressure, psig. $R_o = \text{outside radius of shell, in.}$ $S = \max_{i=1}^{n} \text{maximum allowable working}$

stress, psi. E = efficiency of longitudinal joints in shell, expressed as a decimal.



Eq. (1) is useful and applicable to cases where t does not exceed one half of the inside radius, or P does not exceed 0.385 SE. The majority of cases handled by the engineer will fit these limiting conditions.

Some of the joint efficiencies given by the code are shown in Table 1. The allowable working stress, S, applies to the metal actually used for the shell. A few representative values for S for various metals are shown in Table 2. For a complete tabulation of joint efficiencies and allowable stress values, the reader is referred to the 1952 ASME Code for Unfired Pressure Vessels.

The pressure nomograph for cylindrical and spherical shells solves Eq. (1) and may be used for calculating either thickness or allowable pressure. On the chart the outside diameter in feet is shown for convenience, in-

stead of outside radius in inches as given in Eq. (1). All other units, however, remain the same.

• Problem: Determine the thickness required for a cylindrical shell having an outside dia. of 4 ft. and an internal pressure of 150 psig. The steel has an allowable working stress of 25,000 psi. The longitudinal joint efficiency is 0.80.

• Solution: $SE = 25,000 \times 0.80$ = 20,000

On the nomograph, find 150 on the pressure scale, follow vertically to the line representing SE=20,000; follow horizontally to the reference line, connect this point with a line to 4 on the diameter scale; and at the intersection of this line with the right-hand thickness scale read $t_e=0.18$ in. Actual thickness of the shell will then be 0.18 in. plus the required corrosion allowance.

Spherical Shells

This formula for determining the thickness of the shell of a wholly spherical vessel is given in the code:

$$t_s = \frac{PR_o}{2SE + 0.8P} \tag{2}$$

where $t_* = \text{thickness of spherical shell, in.}$ $P = \text{maximum} \quad \text{allowable internal}$

 R_o pressure, psig. S = outside radius of shell, in. S = maximum allowable working stress, psi.

E =lowest efficiency of any joint in shell, expressed as a decimal.

The limitations to Eq. (2) are that t does not exceed 0.356 times the inside radius, or P does not exceed 0.665 SE. Note that Eq. (2) differs from Eq. (1) by a factor of two—the thickness of a cylindrical shell is twice that required for a spherical shell, all other conditions remaining the same. Accordingly, the nomograph for cylindrical shells may also be used for



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spherical shells, except that a different thickness scale is used. The left hand side of the thickness scale is used for spherical shells and the right hand for cylindrical shells.

· Problem: Determine the thickness required for a spherical shell using the same conditions as above.

· Solution: Follow the procedure outlined. Read 0.09 on the left hand side of thickness scale. The required thickness is then 0.09 in. plus the corrosion allowance.

Spherically Dished Heads

The 1952 ASME code for Unfired Pressure Vessels has this equation for calculating the thickness of a spherically dished (torispherical) head:

$$t_{ab} = \frac{0.885 PR_b}{8E - 0.1P} \tag{3}$$

where t_{ab} = thickness of spherically dished head, in.

P = maximum allowable internal

pressure, psig.

R_b = inside spherical or crown radius of head, in.

S = maximum allowable working

stress, psi. lowest efficiency of any joint in head, as a decimal.

The above equation applies to heads in which the knuckle radius is 6% of the inside crown radius.

Nomograph for spherical and hemispherical dished heads can be used to solve Eq. (3). For convenience, the nomograph uses the inside diameter in feet instead of inches.

Hemispherical Heads

The code gives the following formula for calculating the thickness of hemispherical heads:

$$t_{AA} = \frac{PR_A}{2SE - 0.2P} \tag{4}$$

where t_{Ab} = thickness of hemispherical head, in. P = maximum allowable internal

 $R_{\rm A} = {
m pressure, psig.}$ $R_{\rm A} = {
m inside spherical or crown radius of head, in.}$ S = maximum allowable working

stress, pai. lowest efficiency of any joint in head, as a decimal.

Eq. (4) applies when t does not

exceed 0.356 R, or P does not exceed 0.665 SE.

By comparing Eq. (3) and (4) it will be seen that the thickness of a hemispherical head is 0.565 times that of a spherically dished head-with all other factors remaining the same. The same nomograph can be used for hemispherical heads using the left hand side of the thickness scale.

• Problem: Find the required thickness for a seamless spherically dished head, having an inside crown radius of 4 ft. and an internal working pressure of 150 psig. The allowable working stress of the metal is 20,000 psi.

• Solution: E = 1 (seamless head), SE = 20,000

On the nomograph, find 150 on the pressure scale; follow vertically to the line representing SE = 20,000; follow horizontally to the reference line, connect this point with a line to 4 on the radius scale, and at the intersection of this line with the tas scale read 0.32 in. The required thickness is 0.32 in. plus the required corrosion allowance.

· Problem: Find the required thickness of a seamless hemispherical head using the same conditions as

 Solution: Follow the procedure outlined. Read 0.18 on the tas scale and add on the necessary corrosion allowance.

Vacuum Service

Cylindrical Steel Shells

Fig. UCS-28 given in the 1952 ASME Code for Unfired Pressure Vessels applies to steel vessels under external pressure, when constructed of steel having a yield strength of 24,000 to 30,000 psi. Most carbon steels

used in construction of vessels fall into this classification-and range of yield strengths.

In calculating the required thickness employing this figure, it is necessary to use trial-and-error. For vacuum work the external pressure is taken as 15 psi. Based on the data in Fig. UCS-28, the nomograph for cylindrical shells under vacuum was developed. It permits you to calculate directly the required thickness of a cylindrical shell, without trial-and-

The length of the cylindrical shell, L, is defined as:

1. Distance between head-bend lines plus one-third of the depth of each head, if there are no stiffening

2. The greatest center-to-center distance between any two adjacent stiffening rings; or

3. The distance from the center of the first stiffening ring to the head bend line, plus one-third of the depth of the head; all measured parallel to the axis of the vessel and in feet not in inch measurements.

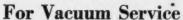
Outside dia. of the shell is D., expressed in ft. On the left hand side of the chart three temperatures lines are given. For temperatures 300 F. and below, use the 300 F. line. For higher temperatures the appropriate line is used-interpolation is permitted. See the nomograph for an example of this.

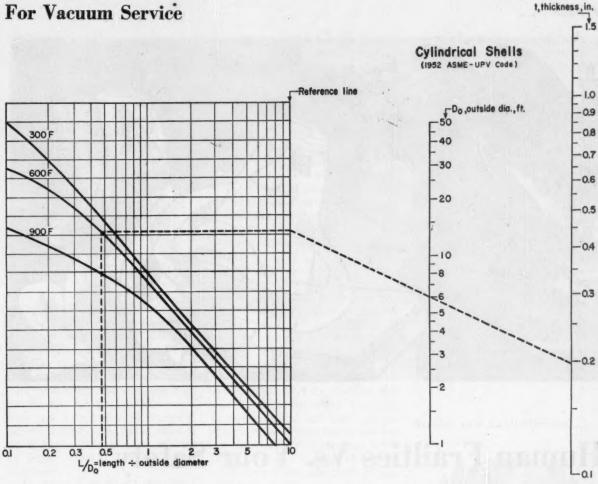
Dished Heads and Spherical Shells

In the 1952 code, Fig. UCS-28 can be used for calculating the required thickness of steel dished heads or spherical steel shells under vacuum conditions.

Based on this figure and an external pressure of 15 psi., the nomograph for spherical heads and shells was developed. It offers a convenient means of getting the required thickness for vacuum service.

For spherically dished heads use the outside crown radius; and for spherical shells use the inside crown radius. To determine thickness draw a straight line between the temperature scale and the radius scale. Thickness is read at the point where this line intersects the t scale. See the nomograph for an example of how a problem is worked





How to Use These Nomographs

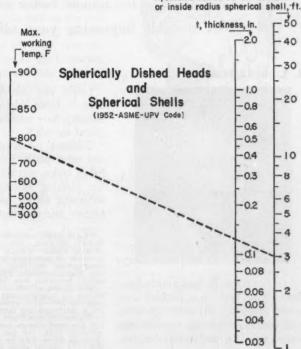
Calculate Thickness of Cylindrical Steel Shells

This is a vacuum distilation column 6-ft. O.D. Plates are welded to the shell, acting as stiffening rings. Plate spacing is 18-in. Distance from the top plate to the head-bend line of the top head is 2-ft. Distance from the bottom plate to the headbend line of the bottom head is 2.5-ft. Depth of each head is 13-in. and max. operating temperature is 600 F.

Maximum L/D_{\bullet} occurs at the bottom of the column. Thus L=2.5+1/3(13/12)=2.86 ft., $L/D_{\bullet}=2.86/6=0.477$. Find 0.477 on the L/D. scale. Follow vertically to the 600 F. line. Follow horizontally to the reference line; connect this point with a line through D. scale to the t scale at a value of slightly less than 0.20-in. The thickness is then 0.20-in. plus the corrosion allowance.

Calculate Minimum Thickness of Flanged, Dished Head Head is under vacuum at a maximum temperature of 800 F. It has a dish radius of 3 ft.

Draw a straight line from 800 on the temperature scale to 3 on the R scale. Read 0.125 on the t scale. Required thickness for the dished head is 0.125 in. plus the allowance for corrosion.



R, outside radius dished head, ft.



Human Frailties Vs. Your Safety

Consider how the human factor causes accidents and you will have a good start towards improving your safety record. It's now the main culprit.

H. L. BULLOCK



LES BULLOCK, Bullock-Smith Associates, New York, is a licensed consulting engineer. His extensive safety work includes explosives manufacture, coating solutions, and mechanical safeguards.

Lately, the chemical industry and even its blood relative, the explosive industry, have established excellent accident records.*

Chemical plants are becoming safer and safer places in which to work. Safety codes, machine guards, protective clothing, automatic controls and automatic alarms have produced extremely safe conditions.

*Last year, according to the National Safety Council, the chemical industry ranked eighth among the 40 major industries in accident frequency rate. The comparable standing for companies in the Manufacturing Chemists Association safety program was fifth.

The chemical industry as a whole has shown an improvement of more than 50% over its 1935-1939 average. The record of MCA participating firms shows a decline in frequency rate from 7.65 in 1946 to 3.22 for the first eleven months of 1954. The severity rate, for the same period, has declined from 0.69 to 0.42. Final figures for 1954 should show a new low by comparison with previous years.

However, accidents can still be caused by the human factor, either in pioneer work where the safety controls have not been fully developed or in established operations where the existing precautions can be rendered inoperative by human action or the lack of it. As our accident prevention work progresses and as widespread use of well designed safeguards is increased, we approach the point where human frailties become the most active cause of accidents.

Decrease of accidents resulting from human frailties can be promoted by considering what these frailties are and how they operate. If we are consciously aware of them, we can combat them in ourselves and act to correct them in others.



One of the most prevalent human frailties is that of laziness or the tendency to make minimum mental or physical effort. As it is marked by the omission of action, it is one of the most difficult to observe and combat. The chronic lazy individual will often go through the motions of doing a duty in a studied effort to deceive or he will make a weak, partial effort as an indication of interest but will fail to follow through to a satisfactory conclusion.

At the start of World War II, I had the privilege of giving safety lectures to groups of young engineers who planned to take operational posts in explosives plants and arsenals. In these lectures, I stressed the necessity of following through in establishing conditions of safe operation. I told the men that it was not enough to report unsafe conditions, that they should insist on adequate action even if it did not seem to be part of their direct duty.

About a year after the start of the lectures, a member of one of the first groups returned to the lecture room. One ear was missing, his jaw was in splints and he showed that he had been through a rather disastrous explosion.

He said that he had dropped in to tell the current class listening to the lecture that they should learn the importance of following through. In the plant where he was working, he had reported an unsafe equipment condition for three successive months, without personally insisting that it should be corrected. When the weak spot gave way during the fourth month and an explosion occurred, he happened to be in the danger zone. He had learned his lesson too late but he wanted others to profit by his experience.

Taking too much for granted is often a form of laziness. Certain chemicals must be handled in special containers and it is always advisable to check the cleanliness of the containers or of the lines used to transport these chemicals. Hydrofluoric acid is one of these sensitive materials and it is customarily kept in lead or rubber containers.

Quite a few years ago, a manufacturer using hydrofluoric acid in his work required a flask on short notice. Two of his trusted employees selected a rubber flask without inspecting it for cleanliness and took a taxi to the plant of the chemical manufacturer.

At the manufacturer's plant, the flask was filled without inspection and the men placed it in the taxi and started back to their plant. Unknown to them, the flask had been used for other material in their factory and was not clean. After they had gone a few blocks, a violent reaction took place which sprayed the interior of the cab with acid.

As the glass slide behind the driver was open and as the reaction was very violent, the driver, as well as the two plant employees, was severely burned. Proper cleaning of the flask, close supervision of its use in the customer plant or adequate inspection at either the chemical manufacturer's plant or in the user's plant would have prevented this accident.

Laziness and Ignorance_

Some accidents are caused by a combination of laziness and ignorance. An operator may not have the technical knowledge to appreciate some special requirement and may lack the energy and personal drive to find out the governing circumstances.

Special alloy steel bolts, made to strict thread specification, are increasingly a part of our equipment assembly. Any necessary replacements should be made with exact duplicates and, when damaged threads must be drilled out and replacement made with a larger diameter screw or bolt, the original material and design specifications should be exactly copied.

Recently, this was not done in the plant of one of our larger corporations. A special alloy steel bolt used for a tension assembly under conditions of extreme vibration became crystallized. When the maintenance mechanic tried to remove it when making some routine bearing replacements, it broke off in the threaded hole. Instead of trying to remove the broken piece, they drilled out the old metric size bolt and re-threaded the hole to the nearest inch size. Then they reassembled the unit, using a bolt made of ordinary steel.

A few hours of operation caused the ordinary steel bolt to break off while the machine was operating at top speed, allowing the tension assembly to fall apart. Luckily, no one was hurt, but very extensive damage was done to the machine.

Heroics and Exhibitionism.



Twin human frailties are heroics and exhibitionism. Human beings like to play the part of the hero and they love to show off.

One of our large plastic companies constructed storage vaults for highly flammable material which were designed with great care to isolate any fire in a single unit and then to extinguish it by flooding action. The vault doors were heavily counter-weighted to insure tight closing, and fusible links in line with the top of the door opening were a part of the system for

holding the doors temporarily open during trucking operations. Fusible link sprinklers were installed in the vaults, and water curtain wall sprays were arranged to cool the walls between adjoining vaults. In addition, a rate of temperature rise alarm was installed in each vault.

One morning fire occurred in one vault. Unfortunately, a new employee discovered the first smoke before the alarm was set off. Not realizing the character of the material in the vault, he judged that he could take care of this small fire himself, so he wedged the vault door open with a heavy piece of wood which was nearby and unlimbered the 3 in. fire hose line in the corridor.

By the time he had a stream of water on the fire, a real conflagration was in progress and large volumes of fumes were pouring through the doorway. When other operators and the local fire department arrived on the scene, the vault door was so warped by the heat that it could not be closed. As the fire department fought the fire, the fumes continued to pour out of the vault door and fresh air was continually fed to the flames. As the stored material was cellulose nitrate, the fumes were both acid and flam-

Several flares of an explosive nature damaged rooms which should never have been reached by the flames, and heavy damage was caused to material and equipment in nearby sections of the plant by the acid fumes. This would all have been avoided if our hero had confined his efforts to reporting the fire and if he had not blocked the door in an open position.

In the above instance, the heroics and exhibitionism and the resulting damage were self-evident. Every year a closely related frailty, the tendency to over-estimate capabilities, causes hundreds of thousands of dollars worth of fire damage. A fire is discovered in the plant. It looks small. The plant men are sure they can extinguish it. No one calls the Fire Department. When it is evident that the fire is out of control, the five to fifteen minutes required for the professional firemen to arrive may mean the difference between a small localized departmental fire and a plant damaging conflagration.

Familiarity Breeding Contempt



There is an old saying that familiarity breeds contempt and this is, unfortunately, sometimes true with people who handle explosive material over long periods.

A good example of the disastrous results of disregarded rules is found in the explosion which occurred at the Lake Denmark Naval Arsenal in 1925. The explosion occurred on a Saturday afternoon and was touched off by lightning hitting a storage building near the main entrance gate. The explosion of this building set off its nearest neighbor and the chain of explosions ran up the hill until even the power plant at the other end of the reservation was destroyed.

The Lake Denmark site had been selected because of the sandy nature of the soil, which made it a poor conductor of explosive shock. Storage buildings containing detonators, booster charges or torpedo war-heads were supposed to be separated by at least two other buildings containing such shock insensitive explosives as smokeless powder and explosive "D." Also, all buildings were physically separated by distance thought to be sufficient to avoid spreading of disaster by heat or shock. In spite of the rules and the elaborate ground plan, the entire installation was destroyed.

Everyone connected with the forming of the rules and layout regulations was puzzled and worried. "Were our calculations concerning shock transmission wrong?" "Could atmospheric conditions exist which made greater distances of building separation necessary?" "What was the cause of the disaster?"

Fortunately, a set of the inventory sheets came through the fire undamaged and, when they were examined, the reason for the disaster was clear. Detonators, booster charges, fuses and war-heads had not been segregated but were scattered through practically all of the buildings. Stores of these sensitive materials were not separated by two or three building distances but were in adjoining buildings easily subject to detonation by shock transmission. Nature had caused the first explosion but human carelessness had made complete disaster inevitable.

Contempt born of familiarity, together with lack of appreciation of explosive potential and of the conditions under which the material becomes extremely dangerous, had led to several disasters with ammonium nitrate. Its wide use in the chemical industry, and in fertilizer manufacture in particular, calls for its bulk storage

and shipment.

Under ordinary conditions, vast tonnages are handled without mishap. Then, unexpectedly, we have the right conditions of localized temperature buildup or of detonating shock to produce disasters such as have occurred in Texas. New Jersey and Germany. In these disasters, supposedly inert ammonium nitrate proved itself a high explosive.

In both the German and New Jersey disasters, the explosion was caused by blasting ammonium nitrate which had solidified in bulk storage. After the events, we cannot be sure whether the explosive used was too powerful either in amount or grade or whether some of the nitrate was over-sensitive. All we can be sure of is that common procedure, i.e., blasting ammonium nitrate, produced a violent explosion. Certainly less violent methods should be used to break up solid masses of this treacherous material.

In the Texas disaster, localized spontaneous heating was indicated as the cause, possibly produced by oxidation of fibrous organic packaging material, intensified by oxygen liberated from the nitrate itself. Whatever the cause, conditions proper for the mass detonation of the nitrate were produced in a crowded harbor with disastrous results. Strict observance of storage and shipping regulations covering this material is necessary.

Lack of Interest in Job.



Very often we hear that the modern worker lacks interest in his job and this is classified as a human frailty. Sometimes this lack of interest is a personal trait of the poor workman and sometimes it is the result of our excessive systemization and staff organization in modern plant management. In either case it is difficult to combat, but we do require a certain degree of personal interest in the worker and of worker interest in his job to insure safe operation.

Supervisors should give enough attention to the operators to generate interest in their job and they should never let the presence of distinct production, quality control, maintenance and engineering departments serve as a basis for a "pass the buck" attitude. We must remember that especially around explosive material we are our brothers' keepers.

In a certain plant manufacturing pyrotechnic materials, very rigid lines were drawn between the various departments, with very definite zones of responsibility. One morning an explosion occurred in an intensive mixer. The isolated mixing room was damaged and the mixer was wrecked but, fortunately, due to the rules of operation, no one was injured.

The explosion was somewhat of a mystery at first. The mixers were designed with only 50% of the frictional area used in standard machines of the same type and the operating speed was specified at about one-half that used in normal operation. Operating under these conditions, repeated tests had shown that no dangerous tem-

peratures were generated, but an explosion had occurred.

When I arrived at the plant, the management assured me that the mixers had been operating at a speed of from 16 to 19 rpm. Upon visiting the scene of the explosion, I asked the operator how fast the mixer was operating and he said, "This was a fast one—it went about 40 rpm." I then asked the foreman how fast it had been operating and he said, "From 40 to 45 rpm., as near as I could figure with my Ingersoll."

Management shook its head, claiming that none of the mixers could go over 19 rpm., so I requested that we visit the motor room on the other side of the 18 in. reinforced concrete wall.

There the answer was evident. All the mixer drive shafts were supposed to be driven by a gear reducer placed between the motor and the shaft. In this particular room, an air pump and tank were in the location ordinarily occupied by the reducer so the erection mechanics had hooked the motor direct to the drive shaft extending through the wall. The foreman and the operator were right. The mixer had been operating at over 40 rpm. They had observed the difference but felt it not their duty to report it.

This illustrates a case of multiple contributory factors, all of them due to human frailty. The erection crew took the easiest way. Inspection was lax or non-existent. The production crew lacked follow-up interest, possibly because of memories of past friction over division responsibility. As a result, a dangerous condition existed until a combination of circumstances produced the explosion.

Ignorance.



Chemical advances are made so rapidly that we will always be faced with the hazard of human ignorance. In view of the rapidity of development, simple ignorance is excusable. But the human trait of active curiosity coupled with lack of knowledge often produce unfortunate results. This places the responsibility for safety on the informed development and research men in their contact with operators in the pilot plant and in full scale operation.

We are all familiar with the minor laboratory accidents resulting from the effort of a student or worker to take home a sample piece of sodium or phosphorus to show the folks. I recall an instance where an accident was

avoided when I discovered a laboratory worker leaving for home with a tightly sealed glass bottle filled with dry ice in his coat pocket.

Now that radioactive materials are coming into general use, we have many more dangerous materials. The hazards are greatly multiplied by the fact that very small amounts can cause great damage. As these materials come into increased use, we will have to emphasize their dangerous characteristics and enforce very rigid rules concerning their storage and inventory status.

It may appear that a large portion of the hazards covered in this article has been connected with the explosive industry. This is necessarily true because the examples have been drawn from the past when the greatest dangers existed in explosives manufacturing. This condition will not necessarily apply to the future as we employ more and more nuclear reactions, and as more processes using high pressure and temperature come into use.

To maintain and possibly improve our present low accident rate, we must develop better training courses and insist on closer supervision in the plant. These measures, coupled with the provision of improved mechanical and electrical safeguards, can aid us greatly in avoiding the dangers resulting from human frailties.

Engineering in Salt Manufacture

Two noted authorities discuss the newer and less orthodox processes in this the last of a two-article study of advances in salt making.

W. L. BADGER and F. C. STANDIFORD

In our previous article, we described the improvements in the design and operation of conventional salt plants. This article describes and compares some of the less orthodox processes.

Two types of evaporated salt are marketed-grainer or flake salt and vacuum pan or granulated salt. Nearly all of today's production of both types is now made by the processes described last month. However, some new processes promise important savings and may eventually provide an appreciable portion of refined salt production. magnesium chlorides usually present, and an exceptionally high purity of about 99.98% NaCl can be obtained.

Steam consumption of the process is only about 3,000 lb. per ton of salt, only a third that of a grainer and about the same as that of a double effect evaporator.

New Flake Salt Processes

Since the grainer process is by far the least efficient common method of making salt, development work has been concentrated in this field.

Grainers* must operate single effect since they depend on evaporation from a quiescent brine surface to produce the hopper-shaped crystal demanded. Dilution of the vapor with large volumes of air makes it impossible to reuse the heat in the vapor, and total steam consumption is almost 9,000 lb. per ton of salt produced.

Grainer coils must be cleaned frequently to remove calcium sulfate scale, and operation and maintenance labor usually amounts to one manhour per ton of salt. Further, the calcium sulfate co-precipitated with the salt and the soluble impurities trapped in the crystals lower purity.

Alberger Process Was First

First real improvement was the development of the Alberger process just prior to 1910. This process has been described a number of times. so only more recent improvements are described here.

Grainers are flat open pans, 15 to 20 ft. wide, 150 to 200 ft. long and about 2 ft. deep. Steam coils are submerged in the pan to heat the brine, and a system of rakes at the bottom collects the salt crystals.

W. L. Badger, consulting engineer of Ann Arbor, Mich., is a recognized authority on evaporation processes. F. C. Standsford assists Dr. Badger in his consulting practice.

A flow diagram of the process is shown. A stream of fresh brine feed and recycle brine is heated in a number of shell and tube exchangers—the last supplied with high pressure steam. Hot brine then passes through a graveler containing a bed of carefully selected stones.

Calcium sulfate has an inverted solubility curve, and at the high temperature of the brine, it precipitates onto the stones. On subsequent flash cooling, the brine becomes unsaturated with respect to calcium sulfate and there is no further deposition. Hot brine from the graveler is flash cooled in a number of stages, and vapor from each flasher goes to one of the brine heaters.

Brine from the last flasher is slightly supersaturated with respect to sodium chloride. This brine then goes to a large circular grainer pan where surface evaporation cools it further and precipitates the flake crystals characteristic of grainer salt. The salt is raked out of this grainer, which contains no heating coils, and the cooled overflow brine, together with fresh makeup brine, is sent back to the heaters.

Advantages

By separating calcium sulfate before salt precipitates, the product is practically free of this impurity, the major contaminant of most evaporated salt. Brine feed to the Alberger process is usually chemically treated to remove the small amounts of calcium and

Disadvantages

Although it is the aim of the Alberger process to deposit all calcium sulfate in the graveler this cannot be done in practice. Brine in all the tubular heaters is supersaturated with respect to CaSO₄, and scale forms in the tubes. The rate of scale formation increases with increasing temperature, and tubes of the last or highest temperature heater must be drilled out daily. Other heaters have to be cleaned at intervals ranging from once a week to once a month.

Since the last flasher operates at substantially atmospheric boiling point, the last heater and first flasher are maintained at fairly high pressures. This makes it necessary to use high pressure (about 80 psig.) steam as the primary heat source. Since most salt plants obtain their power from noncondensing turbines, this need limits the amount of power that could be produced. Thus the Alberger process is not well suited to plants where it is the only salt-making process used.

Operating the grainer at high temperatures gives a smaller, more fragile crystal than conventional grainers.

While Alberger salt can be substituted for grainer salt in many applications, it cannot be used where large crystals are needed—such as in the salting of fish or hides. In other cases, however, the small crystal size and high purity make it greatly superior to ordinary grainer salt.

Morton Process Saves Steam

Another means of improving the economy of flake salt manufacture is

the process developed by W. F. Farnsworth' for the Morton Salt Co. This process uses a recirculating brine system, flasher, grainer pan and shell and tube heater in much the same way as the Alberger process. Main differences are that only one heater and one flasher are used, and the flash vapors can be recompressed for reuse.

In operation, saturated brine from the grainer pan is heated and thus it becomes slightly unsaturated. It is then possible to flash cool to some extent without depositing salt crystals. Crystallization in the flasher is not wanted because here the salt forms small cubical crystals—not flakes.

Temperatures and flows are such that about half the evaporation can be accomplished in the flasher before the brine reaches saturation. Since vapor formed in this flasher is not diluted with air, it can be used for other processes, or, as in the illustration, can be compressed to serve as part of the heating medium for the brine heater.

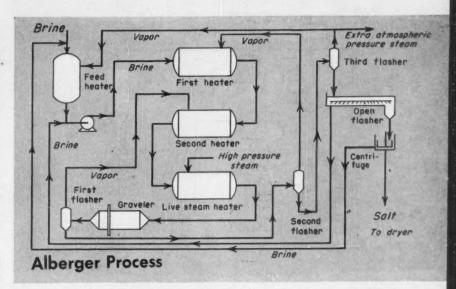
If a thermocompressor is not used in this process, steam consumption per ton of salt equals that of a conventional grainer, but about 40% of this steam is recovered for other uses at a pressure slightly less than atmospheric. If a thermocompressor is used, net consumption of fresh steam will only be about 60% that of a conventional grainer. However, this steam saving is realized only by expending much power for the compressor.

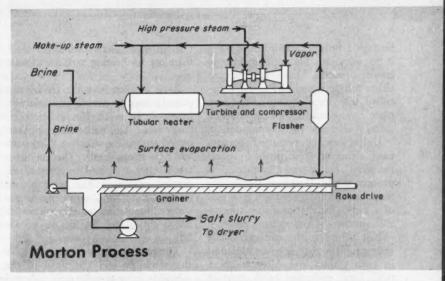
Advantages

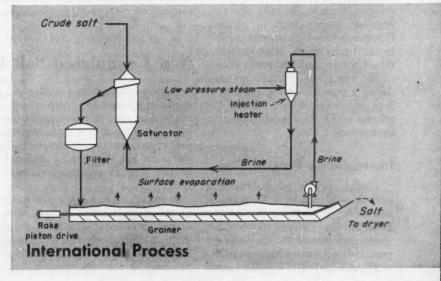
Principal advantage of this process is the saving in steam or the ability to recover low pressure steam for other uses. By using a compact heat exchanger instead of steam coils in the grainer, construction is greatly simplified. The grainer need be only half as large as usually required since only half the evaporation takes place there. Small size and the elimination of heating coils makes rubber-lining the grainer and using corrosion resistant steel practical, preventing grainer corrosion and off-color salt.

Disadvantages

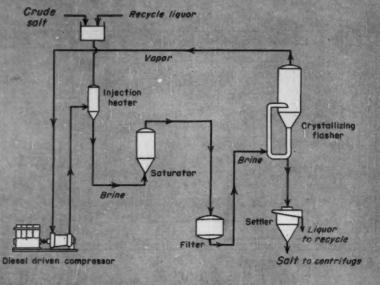
Power can be obtained very cheaply in a conventional salt plant by generating steam at moderate pressures (100-200) psig.) and passing this steam







Richards Process (Thermocompression)



through a turbogenerator before using it to evaporate brine. The Morton grainer process, however, requires either a large amount of power if operated with thermocompression, or a place to use subatmospheric pressure steam if used sans thermocompression.

Unless very high pressure boilers are used, either of these methods upsets the plant's steam-power balance. The process would therefore show little economic advantage except as a part of a larger installation using appreciable amounts of low pressure steam.

Not solved is the calcium sulfate scale problem that is so troublesome in both grainer and Alberger operation. Heat exchanger tubes must be descaled much as the coils of a conventional grainer must be cleaned. However, with a high velocity possible in the heater tubes, scale formation should not be nearly as severe as it is on the usual coils. Further, by introducing a graveler after the heater, it is possible to precipitate some of the calcium sulfate that would otherwise contaminate the salt.

International Cuts Scaling

Another process for making flake salt was developed by R. G. Richards and C. M. Hopper for the International Salt Co. This process, too, bears some resemblance to the Alberger process—but it uses no heating surfaces at all. All heating is by direct injec-

tion of steam into the brine; thus, there are no heating surfaces to scale

Brine is taken from the grainer and passed through a direct steam injection heater—built much like a barometic condenser. This hot brine is then passed through a saturator filled with any type of crude salt. The hot, saturated brine is filtered to remove suspended calcium sulfate crystals and discharged to the grainer pan where surface evaporation removes previously added steam and deposits flake crystals.

The process takes advantage of both the solubility and the slope of the solubility curve of sodium chloride and requires less evaporation per pound of salt made than any other process. It is possible to make almost twice the normal amount of salt per unit of grainer surface by this method—without having to go to higher evaporating temperatures. This means that the grainer pan would have to be about the same size as the Morton grainer for the same production rate.

Advantages

The process uses less than half the steam needed by conventional grainers and only a very small amount of power for brine circulating pumps. Steam pressure can be very low since there is no loss due to temperature drop across heating surfaces.

Normal impurities, such as calcium sulfate, are eliminated before the salt precipitates. Soluble impurities, if present in the crude feed salt, can either be washed out of the product or removed chemically. In using the latter method, treating reagents can be added directly to the circulating brine stream and the precipitate removed on the filter without any complications of added equipment.

Disadvantages

Only disadvantage of this process is the need to use solid salt as raw material. This usually makes it unsuitable where only brine is available.

Almost any type of crude solid salt can be used, however, including solar salt, rock salt, floor sweepings or a waste salt from a vacuum salt plant. In fact, it has even been found economical to operate the process with a feed of regular vacuum salt.

New Granulated Salt Process

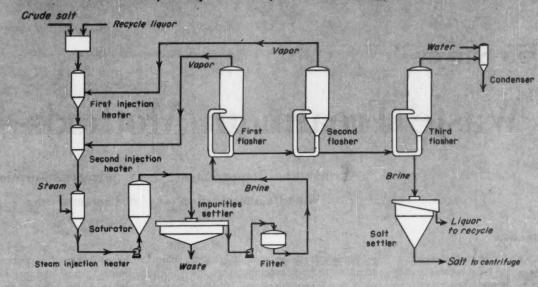
Salt crystallized from a rapidly boiling brine solution forms cubical crystals such as are seen in common table salt. This salt was once made in open pans operating at the atmospheric boiling point but the thermal efficiency of this type of operation was very low.

Practically all such salt is now made in the multiple effect vacuum evaporators described last month. Since multiple effect evaporation is the most efficient of the common salt making processes, it accounts for over 80% of the total refined salt production in the United States.

Richards' Process Two Way

Only one new process has been developed that shows better efficiencies and lower costs than vacuum evaporators. This is the process developed by Richards and Hopper* 7 for the International Salt Co. and is simply another application of the principle on which the International grainer is based. Main difference is that the hot brine

Richards Process (Multiple Effect)



is flashed under vacuum in a closed flasher instead of being cooled in contact with air in an open pan.

There are two possible ways of operating such a process—thermocompression or multiple effect. The flow sheet of a thermocompression unit is shown. Like the International process for grainer salt, this process uses crude solid salt as starting material. This is added to the cooled overflow brine from the settler and the resultant slurry is heated. Steam from the compressor is injected directly into the slurry in the heater.

Flows are so proportioned that the increase in solubility due to the temperature rise plus the dilution due to the steam addition are just enough to dissolve the solid salt. After passing through a saturator, which holds it long enough to dissolve the salt and settle impurities, brine is filtered.

Clear filtered brine is then flashcooled in the crystallizer back to the temperature of the heater inlet. This liberates vapor which, when compressed, supplies practically all of the heat needed by the injection heater.

Flash cooling in the crystallizer also deposits a quantity of salt crystals equal to that fed to the heater. The resultant slurry of refined salt is withdrawn to a settler and the salt recovered by a filter or centrifuge. Clear settler overflow brine is then recycled to pick up more crude salt and be reheated.

Since there are no heating surfaces involved and since there is no loss in boiling point elevation, this system theoretically could work with practically no temperature difference between heater and flasher. However, for a given production rate, brine circulation is inversely proportional to the temperature difference.

To keep the piping sizes and especially the filter sizes within reason, it is necessary to operate with a considerable difference in temperature between heater and flasher. Even then, however, power requirements are much smaller than for a conventional thermocompression salt plant. In a 100-ton-per-day unit, the compressor will use only about 100 hp.-hr. per ton of refined salt.

Where fuel is cheap relative to power or diesel fuel, such as it is in the United States, a multiple-effect Richards' process is more economical than a thermocompression unit. Such an arrangement is shown above. It differs from the thermocompression unit only in (a) use of steam from a boiler, and (b) heating and flashing the brine in more than one stage.

Flash vapor from all but the last stage can then be used for partially heating recirculated brine, thus reducing consumption of boiler steam. Actual steam requirements are approximately 3,600 lb. per ton for single, 1,900 lb. per ton for double, and 1,400 lb. per ton for a triple effect unit.

Advantages

There are a number of advantages in this process.

- First cost of equipment is low and there is no possibility of scale forming, since there are no heating surfaces.
- Steam consumption is very low —only about 55% that of an equivalent conventional vacuum plant.
- Calcium sulfate and other scale forming impurities are almost quantitatively separated from the salt, so salt purity is exceptionally high.
- Soluble impurities, such as calcium chloride, can easily be washed out of the refined salt, or, if a very high purity is needed, they can be precipitated in the regular process equipment and the sludge separated on the filters.

Disadvantages

Like the International process for grainer salt the only disadvantage is that the process requires solid salt as the starting material. Again almost any type of solid salt can be used.

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A 1955 Survey:

Waste Treatment Methods—

- Process Improvement
- · Solvent Adsorption
- Waste Concentration
- · Lagoons

H. L. JACOBS

T HERE'S no doubt that many of our river systems have become grossly polluted by wastes resulting from man's effort to obtain the material comforts of life. Industry has polluted its share of receiving waters and it will spend several billions of dollars before the problems of water and air pollution have been brought under control.

Just as people in general have begun to take care of the wastes from their cities, industry has begun the job of cleaning up its wastes. The progress may not have become apparent yet—it's a big job—but much has been accomplished. Here, we will review some of the approaches being made in reducing pollution from organic wastes.

A discussion of industrial waste treatment methods must logically begin with the subject of housekeeping. It is safe to say that most pollution

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problems can be reduced by proper attention to housekeeping within the plant, and few problems will fail to be benefited. The very act of bringing the problem to the front, by an active campaign to reduce wastes, will result in greater care by operators—with a reduction in sewer losses because of reduced spills. It is probable that without such care, nearly any pollution problem can become insoluble. This then can be said to constitute the simplest and most widely used treatment method.

Improve Your Process

"Use of surface instead of steam or water jet condensers can avoid difficult disposal problems . . ."

Another method which can logically be included here is the reduction or elimination of wastes at the source. No one likes to admit that he is operating a process at less than optimum efficiency, but such is frequently the case. The chemical industry is noted for its ability to push equipment beyond rated capacity, usually at the expense of reduced yields.

Up to a point, and neglecting the cost of the waste treatment, it is good business because more pounds of product are produced at no increase in investment. This reasoning can become fallacious, however, when the wastes produced require treatment. It may prove economical to invest in more producing equipment rather than in the equipment to treat wastes.

Waste problems can frequently be solved by radically changing the manufacturing process. By judicious process selection, wastes can sometimes be eliminated or substituted for less innocuous ones. I know of one plant in New Jersey which, at one time, made HCl gas by three different methods: (1) by the reaction of salt and 60° Be. sulfuric acid in a steamheated porcelain-lined vessel, (2) with salt and 98% H₂SO₄ in an oil-fired retort and (3) with salt and 98% H₂SO₄ in a Mannheim furnace.

In the first case, wet HCl gas, free of inerts, was produced as the prime product, while the rest of the reaction products containing half of the acid value were sent to the sewer.

In the second case, HCl containing less moisture was produced as product; with the sodium and sulfate values being recovered as salt cake after neutralization of the acid cake with soda ash.

In the last case, the reaction was carried all the way to completion so that only HCl and salt cake were produced. For a time all three processes were operated simultaneously but as time went on, the Mannheim furnace took over the job. In this way, a pollution problem has been solved without resorting to treatment.

Similar reasoning can be applied to equipment and process design. Injecting live steam into a still pot, when carrying out a steam distillation, may be the cheapest means of heating. Still bottoms then end up in an aqueous medium and must be treated as such. A calandria, on the other hand, may be justified if the still heels then can be kept moisture-free and burnable or disposable by other means.

Use of surface instead of a steam or water jet condenser can sometimes avoid difficult disposal of unwanted

Recovery and Disposal

- Tree Farming
- Waste Incineration
- Chemical Treatments
- Biological Methods
- Catalytic Treatments
- Ion Exchange

distillation products which come off the top of a column. This nonaqueous material may also be disposed of by burning or by other means. In these cases, additional investment in equipment serves as an economical substitute for a waste treatment unit.

At a Du Pont plant in Virginia it was necessary to rebuild some distillation columns which were used for the recovery of acetic acid. While the new columns were being designed, somone had the bright idea that additional plates would improve the efficiency of the columns and would result in somewhat less acetic acid. This meant less B.O.D. being discharged to the plant sewers.

The question immediately arose as to how many plates should be added, and where should the point of diminishing returns be placed. It was known that treatment of the plant effluent for B.O.D. reduction would involve investment of about \$100 per lb. of B.O.D. treated. It was decided, therefore, that this \$100 could logically be invested in the recovery columns, for each pound of B.O.D. which would end up in the acetic acid to be recovered. On that line of reasoning, an additional 20 plates were installed in each column and a substantial reduction in B.O.D. was accomplished.

Concentrate Wastes

"One of the best examples of concentration and evaporation is in the disposal of beer slops . . ."

Wastes can sometimes be concentrated or evaporated to dryness as a means of disposal or recovery. One of the best examples of concentration and evaporation occurs in the disposal of "beer slops" resulting from the manufacture of alcohol from black strap molasses. The "slops" are concentrated to a thick sirup which finds use as a road binder or it can be evaporated to dryness to be incorporated in cattle feed. The residue contains sufficient potassium to make it valuable in fertilizer.

To the best of our knowledge, only one company—Publiker of Philadelphia—is now making alcohol from molasses. They are reputed to be recovering some of their beer slops in ways just described.

The city of Milwaukee has been selling its organic sludge as milorganite for several years, but without profit. The Chicago Stockyards Composting Co. is now entering the field with a \$250,000 plant for disposing of stockyard wastes and sewage sludge. The firm has been testing its procedures for four years and is operating a small plant at the present time. It ultimately hopes to reach a capacity of 50,000 tons of fertilizer per year. Other towns which are trying the composting idea are Oakland, Calif.; Miami, Fla.; Bayside, N. Y.; and Cincinnati, Ohio.

Many plants with acid problems find it possible to recover mineral acids such as hydrochloric, sulfuric and nitric. It is not always possible for an industry to recover its waste acids and to re-use them. Sometimes impurities build up to become an interfering factor in reuse. But such acids can frequently be sold to others to whom the impurities are not critical. A considerable amount of waste

sulfuric acid goes into the manufacture of fertilizer. It's possible that some of the impurities of the acid may prove beneficial in the fertilizer by providing trace elements.

One of the greatest contributions to pollution abatement made by industry is the successful demonstration of many recovery methods. The antibiotics plants have found that the spent liquors contain vitamin B. When concentrated and dried, these wastes can be incorporated into chicken and stock feeds at a profit. Vitamin B and the residual antibiotics make for faster and healthier growth with an over-all reduction in feeding costs. The majority of chickens raised today receive some supplemental vitamins by way of fortified feeds.

The largest source of cattle feed is the waste residual from the distilling industry. Incidentally, this waste may also contain an appreciable amount of vitamin B. The distilleries have probably saved more money by recovering their wastes than any other single industry.

Try Adsorption

"One excellent method for solvent recovery involves adsorption of vapors on activated carbon . . ."

Solvent losses in chemical plants can be responsible for high oxygen demands on streams as well as for unsightliness in the water downstream. On the other hand, if the solvent is miscible with water, it may go to the stream completely unnoticed as far as appearance is concerned. Such compounds as alcohols, aldehydes, acetone and acetic acid are colorless.

The effect on the dissolved oxygen in the stream, however, may be disastrous to fish life. In such cases, the solvent loss must be reduced within the plant by recovery or other means, or the wastes must be treated biologically. Solvent recovery, usually by distillation or fractionation, is standard practice in many industrial plants.

One excellent method for solvent recovery involves adsorption of the vapors on activated carbon or other adsorbents. The adsorbed organics are then steamed out and collected for rectification. The alcohol and ether used in smokeless powder manufacture are recovered in this manner.

Inevitably we must discuss actual treatment of wastes. In this connection, there are some problems which can be solved quite readily by fairly simple means, but there are others which cannot yet be treated economically by any known means, although studies in connection with them have been carried out for years.

Many municipal sewage treatment plants are accepting industrial wastes in their systems. This is an understandable procedure when packing plants, canneries or breweries are involved since wastes from these are easily fermented or decomposed biologically. It is less usual, however, when wastes from the chemical industry are considered. Some organic wastes lend themselves very well to complete treatment along with sewage, and many chemical wastes not susceptible to biological treatment can still be handled in the primary type of plant.

Toxicity is always of some concern in these cases and it is necessary, of course, to keep corrosive and flammable substances out of such a sewer system. It is almost a certainty that combined treatment of sewage and industrial wastes can be practiced more economically together than separately.

Lagoons Are Simple, Cheap

"In Texas, it's quite common practice to use lagoons as secondary treatment units for sanitary sewage."

The simplest of treatment units is the lagoon. Lagoons are used for several purposes. A major one being for the removal of settleable solids. This method is applicable when the solids are relatively small in amount and have no value. Lagooning is also a valuable treatment method when it is necessary to remove oil or floating matter from the effluent with skimmers. Quite frequently the organic content of a waste liquor will be reduced in a lagoon because of the action of bacteria or algae.

In Texas, it is quite common practice to use lagoons as secondary treatment units for sanitary sewage. Substantial improvement in B.O.D. content of the effluent is made because of the action of algae which grow in the pond. Lagoons are usually cheap to construct and economical to operate. Under certain circumstances, however, the cleaning cost can be substantial. If such proves to be the case, it is probably wise to consider settling equipment with mechanical sludge collectors and skimmers.

It might be well to point out here that vegetable canners and processers have used lagoons to retain their wastes during the canning season. Because of its seasonal nature, this industry creates wastes with a high organic content during a relatively short period of time.

The canning season usually coincides with low flow conditions and high temperature in the receiving waters. Unless the peak loads of this kind are leveled out by some means, the receiving waters are heavily overtaxed in their capacity to receive wastes. Since vegetable canning wastes are prone to rather quick fermentation, the use of sodium nitrate in such lagoons is common practice. The salt gives up one of its oxygens easily and thereby prevents anaerobic conditions. While it is not a complete answer in itself, its use does minimize odors to some extent.

Tree Farming

Seabrook Farms in central New Jersey has developed a method for disposal of cannery wastes known as tree farming. This method consists of spraying the screened cannery wastes over waste woodlands through ordinary irrigation nozzles. The application rate is about 8 in. per acre per day, or somewhat in excess of 200,000

gal. per acre per day. Experiments in Minnesota with the use of cannery wastes for irrigation of croplands has proved to be successful for at least two seasons. Not only are the wastes successfully disposed of but the increase in vegetable yields are sufficient to pay for the extra cost incurred in the disposal.

Subsurface disposal of brines is being practiced by the Dow Chemical Co. in several wells at Midland, Mich., and by Du Pont in a single well at Victoria, Tex. There are undoubtedly others. In most cases, the brines are pumped into formations which contain water of the same general character as the wastes. Many oil companies pump their waste brines back into the oil-bearing sands. At Victoria, extensive treatment of the wastes prior to injection is required and the method cannot be classed as cheap. The wells at Midland are 1,500 ft. deep while the one at Victoria is just short of 5,000 ft.

During World War II, much concern was expressed about the effects of TNT wastes on receiving waters. The only treatment method devised so far for either the alkaline or acid wastes from TNT manufacture is evaporation and incineration. The main problem with these wastes is their persistent red color which still carries over occasionally in the incinerated residue from manufacturing operations

Incineration Can Help

"Du Pont burns waste tars and still heels in a special incinerator. Waste oils are used as auxiliary fuel . . ."

Incineration of burnable residues with or without heat recovery is a general practice throughout industry. Many plants combine trash burning with incineration of industrial wastes. General Motors assembly plants burn packing cases, paper, etc., with the residues from paint spray booths and other painting operations.

Lederle combines trash burning with incineration of sewage sludge, animal offal and residues from antibiotic culture. Du Pont burns waste tars and still heels in a special incinerator and some waste oils are used as auxiliary fuel in the power house at its Belle plant. Some aqueous

wastes there are burned with natural gas in an abandoned coke oven. Du Pont also burns chlorinated hydrocarbons at Louisville with absorption of HCl from the combustion gases. The standard safe way for disposing of waste nitrocellulose is by burning. The oil industry has burned its oil sludges for years, quite frequently with recovery of sulfur values in an acid plant.

Chemical Treatment

"It has been shown, on a pilot plant scale, that ozonization can successfully destroy phenol."

It is natural for the chemical industry to think of chemical treatment for improvement of its wastes. Chlorination for the oxidation of organic matter is not a widely used practice in waste disposal because of the high cost. In certain cases, however, it can be very effective. If the problem is a small one or if waste chlorine is available, it's possible that this method will be the most economical one to use. It is an excellent method for destroying phenols in the absence of ammonia or other substances having a high chlorine demand.

For years no really good method was known for the treatment of cyanide wastes. Oxidation with potassium permanganate was used to a limited extent but the cost was excessive and an undesirable sludge problem was created. Treatment with ferrous sulfate has been practiced but rarely reduces the cyanide content below 50 ppm. Lagoons have been used but large areas were required and safety hazards were created. Controlled acidification of some cyanide wastes followed by air stripping have been advocated and practiced but with obvious objections from the standpoint of health. A method of oxidation of cyanides by chlorination without the formation of cyanogen chloride has now been developed and bids fair to become the accepted method of treatment, particularly for the more dilute wastes. The cyanide is converted to cyanate which is relatively non-toxic to fish.

It is worth while mentioning a treatment reported in Chemical Week for Nov. 21, 1953. Trubek Laboratories of Rutherford, N. J., has installed equipment for treating a sludge

containing 10,000 ppm. of cyanides expressed as NaCN. The method is based on the German process for making ammonia and sodium formate from sodium cyanide. It involves heating the sludge to 160 to 170 C. for 4 hr. The cyanide content was reduced to 4 ppm. in their equipment. In this particular case, the method is cheaper than chlorination both in equipment cost and operating cost. No mention was made of the ability of this method to destroy the metallic cyanides. It should also be pointed out that the wastes in this case are considerably more concentrated than is usually the case.

Ozonization has been used to a limited extent for taste and odor control as well as for sterilization of public water supply. A part of the Philadelphia water plant is equipped with ozonators. Generally speaking, the economics are not as favorable as with chlorine. In the treatment of the phenols in coke oven gas wastes, it has been shown, on a pilot plant scale, that ozonization can successfully destroy the phenol without being utilized for oxidation of ammonia. While I know of no commercial use for this method as yet, it is entirely probable that some of the plants now discharging phenols will find ozonization as economical, if not more so, than other methods.

Biological Treatment

"Hercules Powder Co. is now successfully treating wastes, containing formaldehyde, on biological filters."

Biological treatment of sanitary wastes has been a standard method of purification since time began. In fact, it is virtually impossible to prevent such purification from taking place, though there are times when the process becomes extremely unpleasant. Means have been devised, however, for controlling and promoting bacterial decomposition of sanitary wastes. And such terms as primary treatment, activated sludge and separate sludge digestion are now common terms with sanitary engineers.

Nearly all of the means developed for treating sanitary wastes are now being enlisted in the fight to abate pollution from industrial wastes: trickling filters, biofilters, activated sludge, etc. Most industrial wastes do not lend themselves to direct application on these filters because bacteria are absent. It has been found, however, that the wastes can be inoculated with sewage or sewage sludge to provide the necessary bacteria.

Artificial feeding with nutrients frequently provides the key to biological treatment. Many organic wastes do not contain the proper ratio of carbon, nitrogen and phosphorus to provide a proper environment for the bacterial growth. Another valuable bit of information that has been developed is that bacteria which are capable of feeding on the wastes frequently develop in the waste channels and in the receiving waters.

The Dow Chemical Co. found that bacteria capable of destroying phenols were present in the waters below their outfall. As a result, they were able to develop a process for destroying phenols in trickling filters by pumping river water over them and gradually adding the phenolic wastes until the proper bacterial slimes were developed on the filters.

Hercules Powder Co. is now successfully treating wastes containing formaldehyde on biological filters. When their filters were ready for inoculation, they were unable to use sewage sludge because of a polio epidemic raging nearby. Instead, they recirculated water over the filter and adding to it daily 40 quarts of skim milk and a little peptone. The filter effluent was allowed to leak through a drum filled with horse manure. After two weeks, the wastes were gradually added and the filter slimes became altered in a manner necessary for the oxidation of formaldehyde. In addition to treatment of phenols and formaldehyde. trickling filters have been used to oxidize acetic acid, various alcohols and many other organic chemicals. Many times the organic matter is present in a mixed waste and cannot be identified.

American Cyanamid Co. has recently started a plant in Ohio, treating wastes from antibiotic manufacture. Many of the compounds susceptible to biological treatment are usually considered good sterilizing agents. Under the proper conditions, bacteria can be developed which will break them down satisfactorily to simpler compounds. Very acceptable B.O.D. reductions are usually obtained.

Activated Sludge

"... process is called bio-sorption and calls for holding and conditioning by means of aeration of the activated sludge."

The activated sludge process, while differing little in principle but greatly in execution, is also being used successfully for industrial organic wastes. For the most part, it is used in conjunction with trickling filters, particularly when the wastes are of chemical origin. One adaptation of the process by itself is found in the use of a suspended solids reactor equipped with an impeller for mixing and dispersion of the air. The waste is introduced at the bottom of the unit along with a quantity of air beneath the impeller. The impeller serves to disperse the air in fine bubbles which, in rising, create a recirculation of sludge. The mixture of sludge and waste is pulled to the top of the unit and overflows into a circular cham-

After passage downward again, it must move upward through the clarifier section in the typical inverted cone and through the sludge blanket. The clear liquor with greatly reduced B.O.D., leaves by way of a launder while the concentrated sludge is drawn off intermittently from a special thickener compartment. So far work has not progressed beyond the pilot plant scale.

Another variation of the activated sludge process is being tried out successfully on cannery wastes. The process is called bio-sorption and calls for holding and conditioning by means of aeration of the recirculated sludge. The H. J. Heinz plant at Chambersburg, Pa., is using the process with excellent results.

Great interest is being shown today in anaerobic digestion processes for strong wastes. There is a possibility that many wastes which would require large volumes of diluting water to render them suitable for aerobic treatment will be more economically treated by anaerobic means. The process is practical only with wastes high in B.O.D. Experiments with paper

mill wastes have shown great promise for anaerobic decomposition and any organic waste resulting from the processing of foodstuffs should respond well to the method. Some of the stronger distillery wastes have been found susceptible to treatment by this means.

Catalytic Treatment

"Catalytic oxidation, while not the answer in every case, has certainly solved quite a number of fume problems."

A typical industrial approach to the problem of rendering organic wastes harmless has been the development of catalytic processes for burning with air. Varnish and resin kettle fumes have been a headache to paint manufacturers and to residents in their vicinity. Many scrubbing devices have been tried, mostly with indifferent success. Catalytic oxidation, while not the answer in every case, has certainly solved quite a number of fume problems. A chemical engineering approach has also been applied to problems of aqueous wastes containing relatively high concentrations of organic matter. Organic-bearing wastes are vaporized when necessary and are passed through a catalyst bed after admixture with air. Organics are consumed by oxidation and harmless CO₂ and water vapor are discharged to the atmosphere.

This process is too new for an accurate economic comparison with biological process. Indications are that catalytic oxidation will be cheaper to install but more expensive to operate. One thing is certain, the area required for installation of biological filters is far greater than for catalytic oxidation of the same waste.

Another method based on chemical engineering principles, the Salvo process, is receiving serious attention. It was originated by the Sterling Drug Company which has successfully treated sulfite wastes on a very small scale. It is a method for oxidizing organic matter in aqueous solution by the application of heat under pressure. Aqueous wastes are mixed with air and forced through a heated reaction vessel under pressure high enough to maintain liquid conditions throughout.

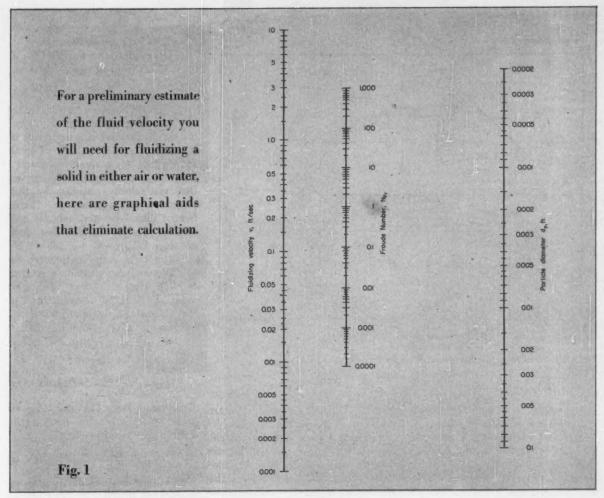
The process will probably work satisfactorily on many wastes but the engineering problems involved in the compressor design are very large. For most wastes, the pressures involved are in the neighborhood of 1,500 lb. per sq. in. or higher.

Ion Exchangers

Closely allied with activated carbon in the field of adsorption are the various kinds of ionic exchangers. While the phenomenon is not always absorbtion or adsorption, the result is somewhat the same. The materials which separate on the ion exchanger can be recovered in a more concentrated form than that which existed originally. While recovery or removal of metallic ions is more commonly the process used, the method lends itself also to the separation or recovery of organic matter. Ion exchangers are available which remove either ionized or non-ionized molecules. Sometimes the exchanger can be regenerated with water or rather the adsorbed material may be extracted with water.

Phenol is strongly held by ion exchange resins and both cation and anion types have been used for its removal and recovery from waste waters. The recovery of edible syrups from pineapple wastes, citrus fruit wastes and black strap molasses has been made possible by ion exchange. Inorganic and organic materials are removed selectively and the color is improved. Here in Texas in the Rio Grande Valley, pectin has been successfully recovered from grapefruit hulls with carbonaceous ion exchange materials in the acid form. It is understood that a heavy freeze ruined the grapefruit trees and caused suspension of the operation. It will doubtless be revived.

This rather sketchy discussion is intended only to guide others in the solution of their problems. Industrial waste problems are not solved by picking ready-made treatment processes off a shelf. In most cases, small-scale experiments should be made before the final treatment equipment is installed. It is almost axiomatic to say that all possibilities except treatment should be explored first. If treatment is called for, the foregoing discussion may be of some help.



NOMOGRAPH for calculating Froude Number or velocity

FOR FAST ESTIMATES OF . .

Fluidization Velocities

J. LOWENSTEIN

During the preliminary design of fluidization equipment, it is often impossible to predict fluid velocities necessary to move the solid in question. This paper presents a graphical approximation of required fluidization velocity based on empirical relations.

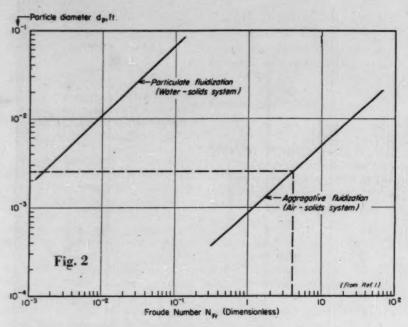
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Fluidization is most conveniently broken down into two types: particulate and aggregative. The former usually occurs in liquid-solids systems and is characterized by uniform bed expansion with increase in fluid velocity and uninhibited particle behavior. Aggregative fluidization occurs mostly in gas-solids systems, and is characterized by bubbling action at the surface of the bed and the ejection of particles or clusters of particles above the bed. This action is very similar to that

which takes place when a high-velocity gas stream is blown through a liquid.

Experiments by Wilhelm and Kwauk' suggest that a correlation between particulate and aggregative fluidization can be arrived at by means of the dimensionless Froude Number N_{Fe} :

 $N_{Pr} = v^2/d_{pq}$ (1) where v is the fluid velocity at the point of fluidization, and d_p is the particle diameter. Due to the greater velocities necessary to fluidize a gas-



FROUDE Number vs. particle size at fluidizing velocity.

solids system, the Froude Number for this type of fluidization usually is greater than unity, while Nr. for particulate fluidization is usually less than unity. A nomograph of the Froude function is presented in Fig. 1. This alignment chart solves directly for the fluid velocity, if the particle diameter and Froude Number are known.

In designing a fluidization system, the required superficial fluid velocity is usually not known. To determine this unknown, reference should be made to Fig. 2. This represents the data of Wilhelm and Kwauk plotted on log-log paper, and consists of results obtained for glass beads, catalyst beads and fine sand. (The lines are in actuality averages of data points.) As can be seen, two distinctly separate straight lines are obtained, one for each system.

To use Figs. 1 and 2 to determine approximate values for fluidizing velocity, the following procedure is

1. Calculate the particle diameter in feet. (If this is not feasible, determine the diameter of an equivalent

2. Enter Fig. 2 horizontally from the left, at the correct value of d, until the desired fluidization curve is

reached. Then read straight down for the value of the Froude Number.

3. Using Fig. 1, draw a straight line through the values for particle diameter and Froude Number, continuing on to the Velocity axis. The intersection of the line with this axis represents the velocity required for fluidization.

Example—It is desired to fluidize a bed of catalyst beads of 0.03 in. average diameter, using air. What is the minimum air velocity necessary to accomplish this?

NOMENCLATURE

= Generalized shape factor (from effective diam.); = 1.0 for spheres; (dimensionless).

Effective particle diameter, ft.

Particle diameter, ft.

Density of gas, lb./cu. ft.

Bed density at maximum porosity, lb./cu. ft. lb./cu. ft.

Acceleration of gravity, 32.2 ft./

sec.*

Critical mass velocity at which fluidization starts, lb./(ft.* sec.).

Number of particles per unit volume of bed at maximum poros-

ity, 1/cu. ft. Froude Number (dimensionless). Critical Reynolds Number (dimen-

Dynamic viscosity of fluid, lb./

(sec.-ft.). Fluid velocity at point of fluidization, ft./sec.

1. $d_p = 0.03$ in. = 0.0025 ft.

2. Using Fig. 2 we find that for a d, of 0.0025 ft. in an air-solids system, $N_{rr} = 4.0.$

3. Going to Fig. 1, we connect 0.0025 on the d, axis with 4.0 on the N_F, axis. The intersection of the extension of this line with the v axis is found to be at 0.57 ft./sec., which is the required minimum air velocity.

It must be remembered, however, that the velocity obtained by this method is only approximate. Therefore, it should be used only for preliminary design considerations, and not as a final result.

For a more rigorous approach to this question, the equations suggested by Van Heerden, et als should be used. The correlating factor there is the Critical Reynolds Number Reo, below which no fluidization begins:

$$Re_0 = G_0 d_*/u \tag{2}$$

This can also be expressed by

$$Re_{\theta} = \frac{0.00123}{B_{\bullet}} \cdot \frac{e \cdot e_{bm}g \cdot d_{\bullet}^{3}}{u^{2}} \quad (3)$$

Combining Eqs. (2) and (3) we arrive at an expression for G, the critical mass velocity:

$$G_0 = \frac{0.00123}{B_{\bullet}} \cdot \frac{e \cdot e_{bm}g \cdot d^2}{u} \quad (4)$$

This critical mass velocity, usually expressed in lb./(ft.ª sec.), represents the minimum velocity necessary to effectively fluidize the entire bed.

Eq. (4) is quite easy to use, except that the various values for B, u, e, etc., have to be calculated first. The final result for Go is, of course, more exact than the value of v derived from Fig. 1, but again it must be remembered that the nomograph of Fig. 1 is only to be used for a rapid estimate of the required fluid velocity.

It should be noted that effective particle diameter d, may be calculated by means of the following equation:

$$d_* = 1.043 / (n_m)^{1/3} \tag{5}$$

The effective diameter of a powdered solid is the diameter of the sphere with the same number of particles per unit volume of packed bed, both counted at maximum porosity.

REFERENCES

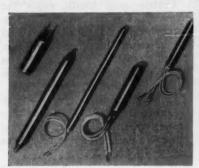
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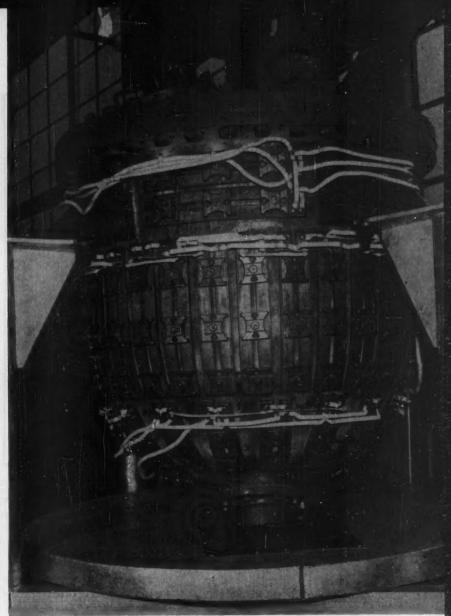
TUBULAR



FIN-STRIP



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STRIP HEATERS

Take a Look at Electric Heaters

They've grown into major processing tools. Using any combination of these four basic resistance units you can satisfy many process needs. They're versatile, make heating easier.

W. S. EYTH and R. L. FABER

Electric heat is instantaneous, easily controllable, clean, safe and can be tailored to fit individual applications. Moreover, it produces high temperatures readily.

Little wonder, then, that resistance heating has carved a substantial place in process heating and contributed a major share of the five-fold boost in national power consumption during the past 20 years.

The greatest proportion of resistance heaters used today are the enclosed or metal-sheathed type. Heat is produced by a suitable resistance element embedded in refractory mate-

rial and enclosed within a protective, strengthening, metal sheath.

Physically and electrically, sheathed resistance heaters are small in size. However, when used in groups they become full grown process heating units.

While nearly 25,000 variations,

What Electric Heaters Offer

Instantaneous heat
Easy control
Clean, no combustion products
Easily tailored to job
Give high temperature easily
Fit into small space

Where You Use Electric Heaters

To heat medium in kettle jackets
Immersion heating
Gas heating
For high temperature and pressure
Contact heating of vessels
For temperature-sensitive materials
Zone heating
Heating pipelines
For infrared heating and drying
In hard-to-reach locations

sizes and ratings are used today there are but four basic types: strip heaters and the ring-heater modification; finstrip heaters used principally for heating gases; tubular heaters which permit a wide variety of bent shapes and a large class of immersion heaters; and cartridge heaters which probably have less process usage than the other three types.

Basic Trait

One fundamental concept is the key to proper selection and use of sheathed resistance heaters—under any given environmental conditions the heater will put out its rated quantity of heat, no matter how adverse these conditions, as long as it is operating. Thus, when there is good heat transfer between the heater and material being heated sheath temperature will be relatively low. However, if heat transfer is poor sheath temperature will climb until there is sufficient temperature differential to dissipate the rated heat output.

For this reason heat transfer characteristics must be considered first in heater selection. Otherwise, material being heated may be damaged or

heater life impaired by excessive sheath temperature for a particular heater design.

Watt Density Controls Choice

On a given heating application sheath temperature is determined by "watt density"—heater rating, w., divided by heating area, sq. in. Recommended allowable watt densities are shown in the accompanying table at normal operating temperatures for some typical materials commonly encountered.

Note that as materials get more viscous the allowable heat intensities must be lowered. In water, maximum watt density can be used since heater temperature stays essentially at the temperature of the water. Were the same heater to be used in a thermoplastic resin it would be operating at 600 F.; 100 F. above the 500 F. decomposition temperature of the resin and 300 F. above the desired process temperature.

Under the circumstances either the watt density can be decreased or the entire area of the container can be used as a heating surface by clamping the heaters to the outside.

Material Limits Watt Density

Material Heated	Desired Temp., °F.	Allowable Watt Density
Water	212	45-55
Sulfuric acid		30
Ethylene glycol	300	25
Dowtherm A	600	20
Trichloro ethylen		20
Caustie soda	160	20
Mineral oil	250	20
Wax or paraffin	150	16
Molten salt	950	15
Dowtherm E	400	12
Bunker C fuel oil		10
Asphalt, tar	200	6
Asphalt tar	400	4

Figuring the Rating

Once the correct watt density has been established for a given job you can determine required heater capacity in order to select the correct heater ratings.

Heat serves three functions on process applications: melting or vaporizing the material, bringing it up to operating temperature within a given time, and holding it at operating temperature by compensating for heat losses.

Heaters must handle either the larger of the three loads or all three simultaneously dependent on whether the process is batch or continuous. Actual calculated rating for a given system is usually increased by 20-30% to cover contingencies.

On a batch heating cycle the heatup period may call for much greater heating capacity than the operating phase. In such a case it is wise to



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Watt Densities to Heat Air or Steam

	Velocit	y. Ft. per	Sec.
	1	10	20
Stream Temp., °F.			
Steel sheath			
300	10	15	18
500		10	12
700			
Inconel sheath			
300	18	24	30
500	14	20	24
700	12	15	18

Note: Steel sheath—maximum allowable temperature 750 F; Inconel—1,400 F.

lengthen heat-up time, if possible, so that a smaller heater can be used at less initial cost.

Heat Jacketed Kettles

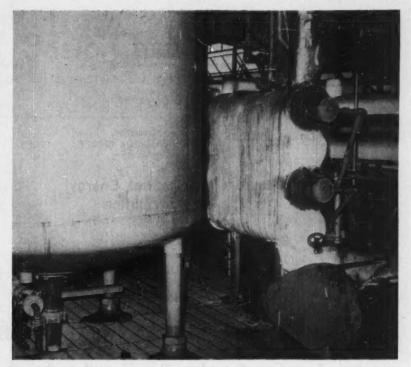
One of the oldest heating systems in the chemical industries is the jacketed kettle. Basically, it's a kettle within an outer enclosure. Heat transfer medium circulates in the space between the kettle and the jacketed enclosure.

With steam as the heat transfer medium, temperature is limited by available steam pressure. At 200 psig. boiler pressure, maximum product temperature will be less than 388 F.

Today many jacketed kettles use liquid heat transfer medium to reach temperatures up to approximately 700 F. Heat can be generated in the heat transfer media either by direct immersion heaters inserted in the kettle jacket or by a circulation heater (heat



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JACKETED KETTLE connected to external exchanger heated by immersion units.

exchanger) connected to the jacketed kettle by piping.

A circulation heater has a bundle of metal-sheathed resistance heaters, either tubular or blade type (strip), welded to a flange or screw plug and inserted into a pipe body. Inlet and outlet connections on the pipe body permit circulation of the heat transfer media.

Ideal for Immersion Heating

Many chemicals with relatively good heat conductivity can be heated by metal-sheathed heating units fitted with flanges or screw plugs for immersion directly in the chemical. Materials such as sulfuric, hydrofluoric and nitric acids, trichloroethylene, plastics, paraffin, sulfur, lead, nitrogen and many powders can be heated in this fashion.

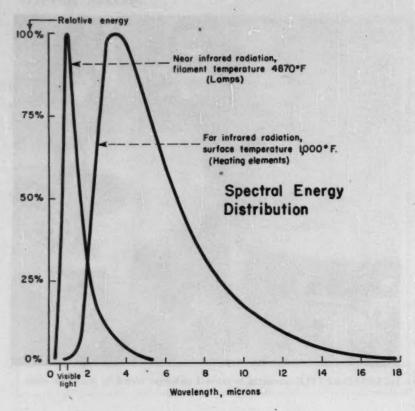
Gases such as air and nitrogen are being heated to 1,500 F. by means of electric heat exchangers. Hairpinshape tubular elements are welded to pipe flanges and inserted into a pipe body serving as the heat exchanger. Because the heaters are immersed in the material being heated, higher heat intensities can be used to cut heater size and expense, shorten heat-up.

Immersion heaters are built as packaged units complete with thermostatic control. One unit of this type has a screw-plug type tubular immersion heater constructed with a dual-purpose liquid-tight or explosion-proof terminal cover containing the thermostat. The thermostat bulb is located in a well that extends through the screw plug between the hairpin elements.

With direct immersion heaters there may be corrosion problems depending on the material or solution being heated. Where corrosion is a factor, metals other than steel (for oil and low temperature gases) or copper (for water) can be used for sheaths. These include 300-series stainless steels, monel, inconel, chemically-pure or antimonial lead, nickel silver, nickel-plated steel and many others.

High Temperature and Pressure

Chemical reactions carried out in autoclaves involve high pressures and temperatures. Pressures of 2,000 psi. and temperatures around 1,000 F. are not uncommon. Direct immersion heaters fabricated with extra-heavy



mounting flanges and extra welding precautions are suitable for this service.

Where heat can be applied to the outside of the autoclave or pressure vessel, strip heaters, ring heaters or specially-shaped segmented strip heaters can be clamped or strapped to the vessel. They can be controlled to heat various zones within the vessel.

Control Stands Out

Materials with poor heat transfer properties require gentle heating to prevent local over-heating and avoid carbonization, in the case of organics. This type of heating application requires a uniform source of controlled heat over the entire area of the container. The metal-sheathed strip heater with its broad, flat surface is ideally suited for clamping to tank walls and provides an excellent means of heat transfer.

As mentioned above, thermostatically-controlled strip heaters permit uniform "zone" heating to coincide with the level of contents in the vessel. Glue and silica gel (dehydrating

Maximum Sheath Temperatures in Air

	Temp., F.
Copper	350
Steel	750
Stainless steel (300 series)	1,300
Inconel	1,450

towers) are examples of materials that are very difficult to heat directly. Many resins also are heated more conveniently by clamp-on strip heaters rather than by immersion heaters.

Keep Lines Open

Another growing application is heating of transfer piping used to move molten solids from one location to another or from one process kettle to another. While the material may be hot as it enters the pipe, heat losses occurring along the length of the pipe must be replaced to maintain the molten state and provide proper flow.

Required heating capacity can be calculated by determining surface area and heat losses through the insulation. For this service strip heaters or tubular elements are curved or bent to fit the contour of the pipe.

They may be fastened securely to the pipe by means of clamping bands, wires or studs.

Where maximum pipe temperatures do not exceed 275 F., flexible heating cable can be wrapped around the pipe. Such cable consists of a resistance wire covered with a special plastic insulation that withstands temperature up to 350 F.

Cable is very simple to install, particularly around irregular bends, pipe fittings and valves. By insulating the pipe and installing a thermostat a permanent installation can be made and heat will be used only as required.

Far Infrared Heaters

A relatively new form of metalsheathed electric resistance heater of real importance to the chemical industry is the tubular, metal-sheathed, far infrared (long wave length) radiant unit. It consists of a rod-type tubular heater placed in front of a parabolic reflector mounted in an extruded aluminum housing.

With a source temperature of approximately 1,400 F. this rugged, unbreakable radiant heater produces nearly all of its radiant energy in the far infrared region of the spectrum. This means that the radiant energy is absorbed with almost equal speed by all colors and surfaces and also will heat translucent material.

These heaters are particularly useful for drying powders, curing resins, fusing vinyls, heating moving-web materials and baking various industrial finishes. There are many other applications where the high intensity and high rates of heat transfer can be used to advantage.

An even more recently developed version of the all-metal radiant heater consists of a number of these units bent in hairpin shape to give a large area of concentrated heat. They are mounted on a panel complete with reflector, insulation, terminal enclosure and mounting frame.

These radiant panels provide a very high degree of intensity and are particularly adaptable to water removal on moving webs and various types of dehydration. Their complete package construction permits easy assembling of enclosures and ovens for mounting on a supporting frame.

Basic Case

Operation at full capacity under current conditions

	Plant A	Plant B	Plant C
Plant cost. Annual sales Turnover ratio Variable operating costs. Fixed operating costs Total operating costs. Earnings before taxes Earnings after taxes Earnings based on sales Return on investment	\$1,000,000 \$2,000,000 2.0 \$1,600,000 \$200,000 \$1,800,000 \$200,000 \$100,000 5% 10%	\$1,000,000 \$1,000,000 1.0 \$600,000 \$200,000 \$800,000 \$200,000 \$100,000 10%	\$1,000,000 \$700,000 0.7 \$300,000 \$200,000 \$500,000 \$100,000 14.3% 10%

What Will Happen to These Earnings

... when economic conditions change? Which plant will be the best investment during inflation or deflation, when meeting price competition, or when operating at reduced capacity?

J. D. JOFFE

Many articles have appeared recently on how to determine plant cost and return on investment under steady economic conditions.

In this article we shall study a



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neglected aspect of engineering economics—what we might call the unsteady or dynamic state. We shall see how various types of changes in economic conditions affect return on investment.

Let's assume that our research division has turned up three potential projects, each requiring \$1,000,000 plant investment. Prospective annual earnings of each plant at capacity operation is \$200,000 before taxes or \$100,000 after taxes (assuming 50% tax rate), for a return on investment of 10% per year.

The three proposed projects differ, however, in their estimated annual sales volumes, as shown in the table above. This difference is readily gaged by either of two factors—the percent of net earnings based on sales, or the ratio of annual sales to capital investment. We usually call the latter term the turnover ratio, or sometimes use the inverse term, capital ratio.

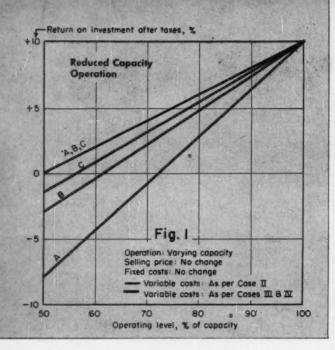
We shall now see how certain assumed changes affect the earnings of each of the three plants—changes in costs of production and sales prices, as well as operation at less than capacity.

Operation at Reduced Capacity

Suppose the market softens or competition increases, so that our plants begin to lose sales and we have to operate at reduced capacity. What happens to our earnings picture?

In Case II (see table, next page), annual sales decline to 75% of original, assuming no change in selling price. Variable costs go down by a similar percentage. Fixed costs, however, stay the same. Under these conditions, the three plants all make an equally poorer showing. The same relation would hold for any reduction in operating capacity accompanied by an equivalent reduction in variable costs.

More realistically, however, variable costs can't be reduced by the exact equivalent of the reduction in output. Suppose, as shown in Case III, vari-



Case II

Operation75% capacity	Variable costsdown 25%
Selling priceno change	Fixed costsno change

	Plant A	Plant B	Plant C
Annual sales	\$1,500,000	\$750,000	\$525,000
Turnover ratio	1.5	0.75	0.53
Variable operating costs.	\$1,200,000	\$450,000	\$225,000
Fixed operating costs	\$200,000	\$200,000	\$200,000
Total operating costs	\$1,400,000	\$650,000	\$425,000
Earnings before taxes	\$100,000	\$100,000	\$100,000
Earnings after taxes	\$50,000	\$50,000	\$50,000
Earnings based on sales	3.3%	6.7%	9.5%
Return on investment	5%	5%	5%

Case III

Operation 75% capacity	Variable costs down 20 %
Selling priceno change	Fixed costs no change

	Plant A	Plant B	Plant C
Annual sales	\$1,500,000	\$750,000	\$525,000
Turnover ratio	1.5	0.75	0.53
Variable operating costs	\$1,280,000	\$480,000	\$240,000
Fixed operating costs	\$200,000	\$200,000	\$200,000
Total operating costs	\$1,480,000	\$680,000	\$440,000
Earnings before taxes	\$20,000	\$70,000	\$85,000
Earnings after taxes	\$10,000	\$35,000	\$42,500
Earnings based on sales	0.67%	4.7%	8.1%
Return on investment	1%	3.5%	4.3%

Case IV

Operation50% capacity	Variable costsdown 40%
Selling priceno change	Fixed costsno change

	Plant A	Plant B	Plant C
Annual sales	\$1,000,000	\$500,000	\$350,000
Turnover ratio	1.0	0.5	0.35
Variable operating costs.	\$960,000	\$360,000	\$180,000
Fixed operating costs	\$200,000	\$200,000	\$200,000
Total operating costs	\$1,160,000	\$560,000	\$380,000
Deficit	\$160,000	\$60,000	\$30,000
Deficit based on sales	16%	12%	8.6%
Deficit based on investment	16%	6%	3%
Deficit, tax-adjusted	8%	3%	1.5%

able costs are 80% of "normal" when operating at 75% capacity. Under these conditions, Plant C makes a much better showing than does Plant A.

The same is true, as shown in Case IV, when variable costs at 50% capacity are 60% of normal. Here all three plants would show a deficit, but they would all continue to operate as long as their deficits were less than the \$200,000 deficit they would show if they were shut down—in other words, as long as they showed a margin on variable costs alone.

When operations are at reduced capacity, therefore, plants with low turnover ratios (or high capital ratios) are the most profitable (or the least unprofitable). This is illustrated graphically by the red lines in Fig. 1 above.

When Selling Price Changes

Under competitive conditions, rather than allow our level of operations to drop, suppose we lower our selling price by 5%, as shown in Case V, in order to hold on to our customers. This would be a wise move, as readily seen by comparing Case V with Case III for all three plants.

If competition increased still further, we might have to operate at less than capacity, even with a reduced selling price, e.g., Case VI.

The effect of any change in selling price, at either 100% or 75% capacity operation, is shown in Fig. 2. Plant A is the most sensitive to changing conditions, Plant C is the most stable. For example, we can afford to lower the selling price for Plant C by 16% in order to maintain

full capacity rather than operate at 75% capacity. For Plant A, the limit is about 9%.

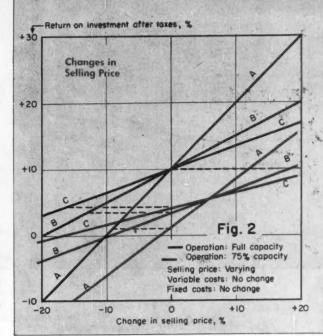
If demand for our product was high enough to support a 10% price increase, Plant A, being the most sensitive, would show the biggest gain, as per Case VII.

If the strengthening in demand occurs while we are operating at 75% capacity, under our assumed conditions we would probably want to get up to full capacity before increasing the selling price. As shown in Fig. 2, Plant B can do just as well at full capacity with no price increase as it could do at 75% capacity with a price increase of 17%. However, if shortages of raw materials or other factors prevented our operating at full capacity, then price increases would be in order at the lower capacity.

Case V

Operation full capacity	Variable costs no change
Selling price down 5%	Fixed costs no change

	Plant A	Plant B	Plant C
Annual sales	\$1,900,000	\$950,000	\$665,000
Turnover ratio	1.9	0.95	0.67
Variable operating costs	\$1,600,000	\$600,000	\$300,000
Fixed operating costs	\$200,000	\$200,000	\$200,000
Total operating costs	\$1,800,000	\$800,000	\$500,000
Earnings before taxes	\$100,000	\$150,000	\$165,000
Earnings after taxes	\$50,000	\$75,000	\$82,500
Earnings based on sales	2.6%	7.9%	12.4%
Return on investment	5%	7.5%	8.3%



Case VI

Operation75% capacity	Variable costs down 20 10
Selling price down 5%	Fixed costsno change

	Plant A	Plant B	Plant C
Annual sales	\$1,425,000	\$712,500	\$498,750
Turnover ratio	1.43	0.71	0.50
Variable operating costs	\$1,280,000	\$480,000	\$240,000
Fixed operating costs	\$200,000	\$200,000	\$200,000
Total operating costs	\$1,480,000	\$680,000	\$440,000
Earnings before taxes	(\$55,000)	\$32,500	\$58,750
Earnings after taxes		\$16,250	\$29,375
Earnings based on sales		2.3%	5.9%
Return on investment		1.6%	2.9%

Case VII

Operation	. full	capacity	Variable costsno	change
Selling price		up 10%	Fixed costsno	change

	Plant A	Plant B	Plant C
Annual sales	\$2,200,000	\$1,100,000	\$770,000
Turnover ratio	2.2	1.1	0.77
Variable operating costs	\$1,600,000	\$600,000	\$300,000
Fixed operating costs	\$200,000	\$200,000	\$200,000
Total operating costs	\$1,800,000	\$800,000	\$500,000
Earnings before taxes	\$400,000	\$300,000	\$270,000
Earnings after taxes	\$200,000	\$150,000	\$135,000
Earnings based on sales	9.1%	13.6%	17.5%
Return on investment	20%	15%	13.5%

Effects of Inflation, Deflation

If inflationary conditions affect prices and costs in the same proportion, return on investment will increase similarly for all three plants, as shown in Case VIII. (Although this example assumes no rise in fixed costs, the three plants would still be on an equal basis if we assumed that fixed costs rose also. Return would drop to 12% across the board.)

Under general deflationary conditions, with prices and costs dropping in the same proportion, return on investment will be uniformly lower across the board for all three plants. Fig. 3 shows the effects of general inflation and deflation.

However, we can't count on being able to raise selling prices in the same proportions as our costs, increase during an inflationary period. This is the squeeze which has been experienced throughout the chemical industry since World War II.

Case IX shows what can happen if costs go up 10% without any increase in selling price. Fig. 4 illustrates the general case where price is constant but variable costs increase or decrease. Here again, we see that Plant C is the most stable investment.

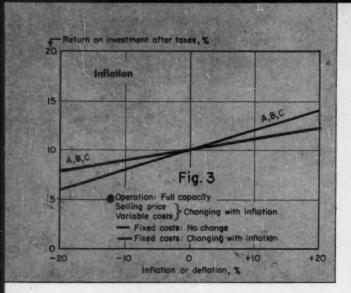
On the other hand, it's possible that during an inflationary period when costs go up by 20%, demand for the product may be sufficient to support a 40% price rise, as shown in Case X. Earnings under these conditions would be high, favoring Plant A.

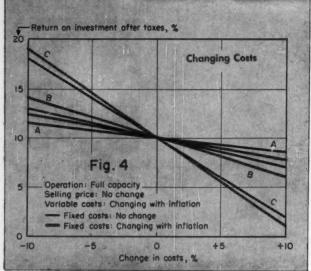
Suppose that shortages prevented our operating at full capacity, giving the picture of Case XI. The inflationary trend still favors Plant A, although the cutback on operating level brings the three earnings of the plants closer together than they were in Case X.

When Making Comparisons

These examples illustrate an important rule which should be followed in comparing project alternatives: Calculate the probable effect of operation at reduced capacity, changes in selling price caused by competitive or supply-demand factors, and changes in prices and costs caused by inflation or deflation.

They also emphasize the danger of evaluating a project solely on the basis of return on investment. Sometimes a high-investment, low-return project may be preferred over other projects on the basis that adequate supplies of raw materials are more readily avail-





Case VIII

Operation . . . full capacity Variable costs up 20 %
Selling price up 20 %
Fixed costs no change

Case IX

Operation full capacity Variable costs up 10 %
Selling price . . . no change Fixed costs no change

	Plant A	Plant B	Plant C
Annual sales	\$2,400,000	\$1,200,000	\$840,000
Turnover ratio	2.4	1.2	0.84
Variable operating costs	\$1,920,000	\$720,000	\$360,000
Fixed operating costs	\$200,000	\$200,000	\$200,000
Total operating costs	\$2,120,000	\$920,000	\$560,000
Earnings before taxes	\$280,000	\$280,000	\$280,000
Earnings after taxes	\$140,000	\$140,000	\$140,000
Earnings based on sales	5.8%	11.7%	16.7%
Return on investment	14%	14%	14%

	Plant A	Plant B	Plant C
Annual sales	\$2,000,000	\$1,000,000	\$700,000
Turnover ratio	2.0	1.0	0.7
Variable operating costs	\$1,760,000	\$660,000	\$330,000
Fixed operating costs	\$200,000	\$200,000	\$200,000
Total operating costs	\$1,960,000	\$860,000	\$530,000
Earnings before taxes	\$40,000	\$140,000	\$170,000
Earnings after taxes	\$20,000	\$70,000	\$85,000
Earnings based on sales	1%	7%	12.1%
Return on investment	2%	7%	8.5%

Case X

Operation....full capacity Variable costs....up 20%
Selling price.....up 40% Fixed costs.....no change

Case XI

Operation...75% capacity Variable costs...down 4%*
Selling price.....up 40% Fixed costs....no change

*20% inflationary rise followed by 20% decline for low-capacity operation

	Plant A	Plant B	Plant C		Plant A	Plant B	Plant C
Annual sales	\$2,800,000	\$1,400,000	\$980,000	Annual sales	\$2,100,000	\$1,050,000	\$735,000
Turnover ratio	2.8	1.4	0.98	Turnover ratio	2.1	1.05	0.74
Variable operating costs	\$1,920,000	\$720,000	\$360,000	Variable operating costs	\$1,536,000	\$576,000	\$288,000
Fixed operating costs	\$200,000	\$200,000	\$200,000	Fixed operating costs	\$200,000	\$200,000	\$200,000
Total operating costs	\$2,120,000	\$920,000	\$560,000	Total operating costs	\$1,736,000	\$776,000	\$488,000
Earnings before taxes	\$680,000	\$480,000	\$420,000	Earnings before taxes	\$364,000	\$274,000	\$247,000
Earnings after taxes	\$340,000	\$240,000	\$210,000	Earnings after taxes	\$182,000	\$137,000	\$123,500
Earnings based on sales	12.1%	17.1%	21.4%	Earnings based on sales	8.7%	13%	16.8%
Return on investment	34%	24%	21%	Return on investment	18.2%	13.7%	12.4%

able at stable prices. Such a project may also serve to minimize the effects of rising wage scales.

In a study of the factors responsible for the failure of some new plants to measure up to expected earnings performance (Chem. Eng., Jan. 1953, 198-200), Tyler found that nearly three-fourths of the trouble was due either to changes in general business conditions or to overoptimistic estimation of sales volume.

It is advisable for engineers making cost studies and executives making decisions to spend the extra time required for considering and weighing all the factors which could affect the success of a proposed project.



Chemical Engineering Fundamentals

Interpretation of Kinetic Data—I



by THOMAS E. CORRIGAN

Our popular CE Refresher author is responsible for research and development at the Doe Run Plant of the Olin Mathieson Chemical Corp. at Brandenburg, Ky. Now in its 20th performance, CE Refresher has become one of the most successful productions in Chemical Engineering. This can be credited directly to Tom Corrigan's ability to write clearly, and his combination of teaching and industrial experience.

Nov. 1954, p. 236; Dec. 1954, p. 198; Jan. 1955, p. 199; Feb. 1955, p. 195; and Mar. 1955, p. 197) we have presented:

• The relationship of catalysis and adsorption.

 The effect of catalytic mechanisms on the form of the kinetic rate equations.

 The derivation of the rate equation for any given assumed mechanism.

• The fundamental hypotheses and assumptions upon which the rate equations are based.

 A brief description of the type of data used to obtain kinetic information.

In this installment and the next two, we'll talk about how to interpret experimental catalytic data in order to select the correct mechanism equation and how to calculate the constants in the rate equation you select.

We will also show how you can test the rate equations determined in this way against the original data. Then how you can use a tested rate equation to calculate the effect of process variables such as pressure, temperature, reactant ratio, space velocity and recycle of products.

Some Necessary Precautions

It is difficult to collect good kinetic data that can be used to obtain a reliable rate equation and to determine the mechanism of a reaction.

One of the major necessary precautions is that the catalyst bed should be kept at a nearly uniform temperature. Complete elimination of temperature gradi-

ents is almost impossible. The variation of temperature with time at a given point in the bed must also be very small. If the chemical steps are being studied, precautions must be built into the experimental apparatus so that the diffusion effects are not important.

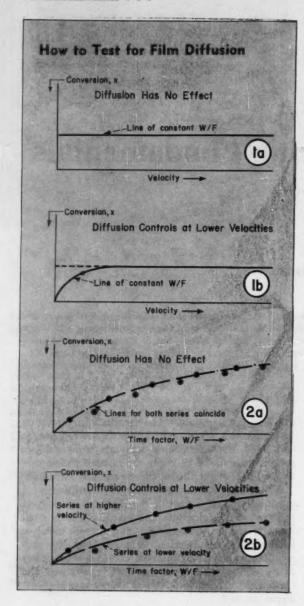
All of these factors contribute to the difficulty of obtaining reliable kinetic data. The use of a good temperature control system, and the use of a fairly small diameter reactor tube surrounded by a thick metal or boiling-liquid heat reservoir, help eliminate the temperature gradients. In some cases the use of pellets of a good conductor, such as copper, mixed with the catalyst can be used to minimize temperature gradients within the bed.

Testing for Film Diffusion

The effects of diffusion are kept to a minimum by using a high velocity through the catalyst bed. We can test for these effects in the experimental reactor by varying the feed rate and weight of catalyst at the same time (to give the same value of W/F at different velocities) and then noting the conversion.

The conversion is measured at a value of W/F at which the gas velocity is low. Then it's measured again at a high velocity, but with more catalyst to keep the ratio, W/F, constant. The two values of conversion will coincide if the effect of diffusion is negligible. If the conversions are different, there is a diffusion effect.

There are two ways to test this effect. One is to make a series of runs at different velocities with the amount of catalyst adjusted to a constant W/F ratio. These



data are then plotted as conversion vs. velocity. If diffusion has no effect, the plot will appear as in Fig. 1a. If diffusion does have an effect, the plot will resemble Fig. 1b.

The other method is to make two series of runs at varying values of W/F but with a constant weight of catalyst in each series. The weight should be different by a factor of two in each of the two series. A plot of x vs. (W/F) is made for each series. If the two curves coincide there is no diffusion effect, but if they are different there is an effect due to the diffusion of the gas from the main stream to the surface of the catalyst. This effect is shown in Fig. 2.

The importance of accurate chemical analysis must be emphasized. In both the differential and integral reactor, accurate chemical analysis is essential.

In the first case, the conversion is small and in the latter case any inaccuracy in a conversion value may greatly affect the shape of the conversion vs. time-factor curve.

Conversion vs. time-factor curves that differ merely because of inaccurate chemical analysis may lead to the conclusion of an entirely different mechanism for the same reaction.

Analysis of Kinetic Data

Kinetic data can be obtained either as "integral-reactor data" where the total conversion is measured as a function of W/F, or as "differential-reactor data" where the reaction rate is measured directly as $\Delta x/\Delta (W/F)$. (In this second case the actual conversion must be very small.)

In most of the kinetic research that has appeared in the literature to date the integral reactor has been used more often than the differential reactor.

The only difference between the two methods is in obtaining reaction-rate values. Once the rates are determined, the methods of interpreting the data are very similar.

There are four general approaches that can be used in the interpretation of kinetic data to determine which, if any, mechanism applies. They are:

• Use initial rates to eliminate most or all of the mechanisms which do not apply.

 Use functions of the reaction rates other than the initial rates to select the mechanism equation which applies.

 Use an integrated form of the rate equation to determine which equation fits the data and to evaluate the constants of the equation.

 Use graphically integrated functions which occur as a series in the rate equations

Only the first and second or these approaches would apply to differential-reactor data.

Analysis of Integral-Reactor Data

Integral-reactor data are usually plotted in the forms of x vs. (W/F). The parameter is either total pressure or feed composition. If the feed is a single reactant as in the reaction

$$A \rightleftharpoons R + S$$

the effect of pressure must be studied as an independent variable. It is usually plotted as the parameter on the x vs. (W/F) curves. See Fig. 3.

Nomenclature (Consistent units)

Empirical constants

Empirical constants	
Empirical constants	
Empirical constants	
Reactants	
Differential operator	
Feed rate	
Rate constant, forward reaction	
Rate constant, reverse reaction	
Equilibrium constant, forward reaction	
Equilibrium constant, reverse reaction	
	Empirical constants Reactants Differential operator Feed rate Rate constant, forward reaction Rate constant, reverse reaction Equilibrium constant, forward reaction

The rate of reaction corresponding to any given value of W/F may then be taken as the slope of the tangent to the curve at that point. The slope at (W/F) = 0, x = 0, is the initial rate, the rate when no products are present. We can determine the initial rate for a series of pressures and plot them. The shape of the r_o vs. pressure curve may be very helpful as a preliminary study of the mechanism.

The general procedure for the use of experimental data for the selection of the mechanism is to derive the corresponding rate equation for each mechanism and then to see which fits the data best. The mechanism that corresponds to the best-fitting equation is taken as the mechanism of the reaction.

How to Determine Initial Rates

There are four possible methods for determining the initial rate from the x vs. (W/F) curve. They are:

(1) Measure the slope of the tangent to the curve at the point x = 0, (W/F) = 0.

(2) Plot x/(W/F) vs. (W/F) and extrapolate to (W/F) = 0.

(3) Measure slopes of tangents at several values of W/F, plot slopes vs. W/F and then extrapolate to (W/F) = 0.

(4) Fit an empirical equation to the x vs. (W/F) curve and differentiate the equation. An empirical equation which may be used sometimes is

 $x = a \tanh [b(W/F)]$

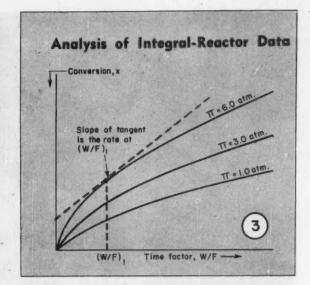
All four methods have their disadvantages and no one is exclusively superior to the other three.

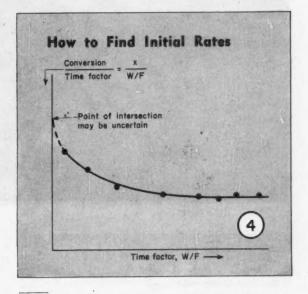
The first is the most direct method but the mechanics of obtaining an accurate tangent at the origin are difficult since the data are least accurate here.

When the rates are determined by measuring the slopes of tangents to the x vs. (W/F) curves, it is also essential that these tangents be drawn accurately. For a curve which is not circular there is no exact geometric construction which gives a tangent. There is one device, the Simons Tangentiometer,* which by the use of mirrors facilitates the construction of tangents to noncircular curves.

The second method of determining initial rates has the advantage of avoiding the tangent construction; but the x/(W/F) value may show a sharp increase, even on log paper as W/F approaches zero (see Fig. 4).

The third method uses data at finite (W/F) values where they are more accurate and also avoids the use of a tangent at the origin.





*Developed and patented by H. P. Simons, Dept. of Chemical Engineering, West Virginia Univ., Morgantown, W. Va.

The fourth method is least cumbersome mechanically but it may not be possible to find the correct equation. A series equation such as

$$x = a + b(W/F) + c(W/F)^2 + \cdots$$

should not be used since the initial rate would depend upon a single value of the constant b. A trigonometric, hyperbolic, bessel or similar function is needed.

The method of obtaining initial rates is a matter of choice, depending upon the nature of the data.

How Useful Are Initial Rates?

Yang and Hougen have discussed the usefulness of initial rates (Chem. Eng. Progress, 46, p. 146, 1950). As

Total pressure

An active center

p Equilibrium partial pressure of adsorbent gas

r Reaction rate

r Initial reaction rate

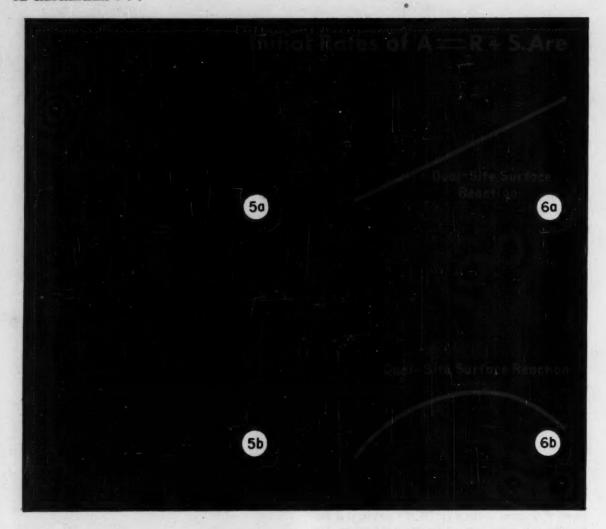
R, S Products

W Mass of catalyst

x Degree of conversion

y Mole fraction of

Finite change



a specific example in illustrating the usefulness of initial rates, consider the reaction

$$A \rightleftharpoons R + S$$

If the mechanism were

$$A + l \rightleftharpoons Al$$

$$Al \rightleftharpoons Rl + S$$

$$Rl \rightleftharpoons R + l$$

with the surface reaction controlling, the rate equation would be:

$$r = \frac{k[p_A - (p_R p_S / K)]}{1 + K_A p_A + K_R p_R} \tag{1}$$

At the initial point where x equals zero, p_s and p_s also equal zero. Then, the equation becomes

$$r_0 = kp_A/(1 + K_A p_A) = p_A/(a + bp_A)$$

where a = 1/k; and $b = K_A/k$.

If the feed is pure Λ , $p_4 = \pi$ and,

$$\tau_o = \pi/(a + b\pi) \tag{2}$$

also,

$$\pi/r_{\circ} = a + b\pi \tag{3}$$

Therefore, #/r. plotted against # will be a straight line

with a positive intercept and a positive slope. We can also see that the r_o vs. π curve will approach 1/b asymptotically, but will not pass through a maximum. Fig. 5 shows such curves.

If the reaction had a dual-site mechanism with surface reaction controlling

$$Al + l \Rightarrow Rl + Sl$$

the rate equation would be:

$$r = \frac{k[p_A - (p_R p_S / K)]}{(1 + K_A p_A + K_R p_R + K_S p_S)^2}$$

$$r_o = kp_A / (1 + K_A p_A)^2 = p_A / (a + bp_A)^2$$
(4)

With pure A as the feed,

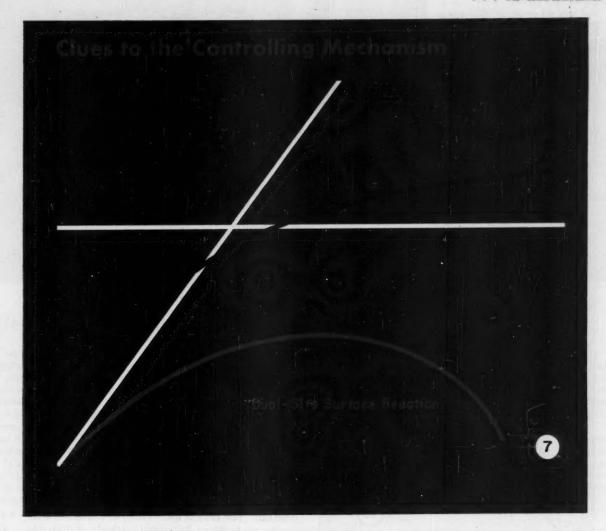
$$r_o = \pi/(a + b\pi)^2 \tag{5}$$

or

$$(\pi/r_o)^{0.5} = a + b\pi \tag{6}$$

Therefore, a plot of $(\pi/I_{\circ})^{0.8}$ vs. π would be a straight line with positive slope and positive intercept (see Fig. 6a).

It's also possible to show that a plot of r_o vs. π would pass through a maximum and then decrease. Take Eq. (5), differentiate with respect to π , and set $dr_o/d\pi$ equal



to zero. This gives $\pi = a/b$. Therefore, a plot of r_o vs. π will pass through a maximum when π is equal to a/b. Fig. 6b shows such a plot.

At the initial conditions,

$$r_o = kp_A/1 = k\pi \tag{8}$$

Thus, a plot of r_o vs. π would be a straight line of positive slope passing through the origin. The π/r_o vs. π plot would be a horizontal line.

If desorption of one product were controlling, the rate equation would be:

$$r = \frac{(k/p_S)[p_A - (p_B p_S/K)]}{1 + K_A p_A + K_S p_S + K'(p_A/p_S)}$$
(9)

$$r_{\bullet} = k(p_A/p_S)/K'(p_A/p_S) = k'$$
 (10)

At the conditions of initial rate the term, p_A/p_θ , is indetermentate since it would be near infinity. However, the ratio appears in both numerator and denominator and we can cancel it out.

Therefore, a plot of r_o vs. π would be a horizontal line. A plot of π/r_o vs. π would be a straight line of positive slope and zero intercept. For the reaction of A going reversibly to R and S, Fig. 7 shows how the

initial rate data can be helpful in establishing the mechanism. Similar results are obtained for the other reactions.

For a more detailed discussion and more sample curves we refer you to the original article by Yang and Hougen.

Initial Rates: Two Reactants

If a reaction is one which involves two reactants

$$A + B \rightleftharpoons R + S$$

the effect of the ratio of A and B in the feed may also be studied as one of the independent variables. This case is also discussed by Yang and Hougen.

Suppose that the controlling step of this reaction is a dual-site surface mechanism. Then

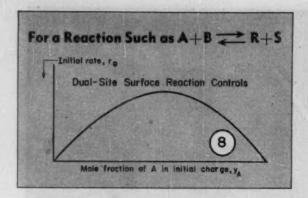
$$r = \frac{k[p_A p_B - (p_B p_S / K)]}{(1 + K_A p_A + K_B p_B + K_B p_E + K_S p_S)^2}$$
(11)

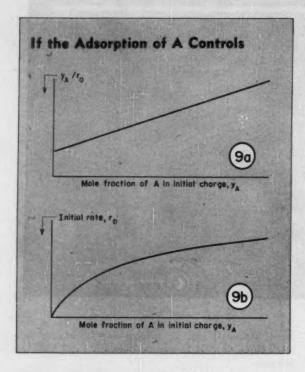
At the initial condition,

$$r_o = kp_A p_B / (1 + K_A p_A + K_B p_B)^2$$

= $p_A p_B / (a' + b' p_A + c' p_B)^2$

$$r_o = \pi 2 y_A y_B / (a' + b' \pi y_A - c' \pi y_B)^2$$





At a constant pressure the initial rate is given by:

$$r_o = y_A(1-y_A)/[a+by_A+c(1-y_A)]^2$$
 where $a=a'/\pi^2$, and $b=b'/\pi$. Another form of this

where $a = a'/\pi'$, and $b = b'/\pi$. Another form of this equation, but with different constants, would be:

$$r_o = (y_A - y_{A^2})/[(a'')^2 + a''b''y_A + (b'')^2y_{A^2}]$$

A plot of r, vs. y₄ will give a curve like that shown in Fig. 8.

If the adsorption of Λ is controlling, then the rate equation would be:

$$r = \frac{p_A - (p_R p_B / K p_B)}{z' + b' p_B + c' p_R + d' p_B}$$
(12)

And at the initial conditions,

$$r_o = p_A/(a' + b'p_B) = \pi y_A/(a' + b'\pi y_B)$$
 (13)
 $r_o = \pi y_A/[a' + b'\pi(1 - y_A)] = \pi y_A/(a + by_A)$

At constant pressure,

$$r_o = y_A/(a + by_A)$$
$$y_A/r_o = a + by_A$$

The shapes of the corresponding curves are shown in Fig. 9. If desorption of a product is a controlling step, then we find that the initial rate is independent of feed composition.

There is an apparent anomaly in Fig. 9. We know that if the mole fraction of A in the initial charge is 1.0, there will be no reaction since there is no B present to react. Yet Fig. 9b shows r_s to increase as y_A increases. It does not show the decrease of initial rate which we would expect as y_A approaches 1.0.

The reason for this is that as the mole fraction of A in the initial charge gets close to 1.0, there will be some other factor controlling (such as adsorption of B or surface reaction) and the curves of Fig. 9 will not hold for the whole range of mole fraction from zero to 1.0.

Yang and Hougen state in their article that the variation of feed ratio at a constant pressure is not so useful as data that involve a variation in total pressure. However, the use of an inert carrier gas may substitute for the variation of total pressure.

The experimental difficulty of obtaining kinetic data that involve a variation of total pressure is greater than the case in which all of the data may be taken at 1 atm. pressure.

Are Initial Rates Enough?

The analysis of kinetic data in terms of initial rates is very helpful as an approach to the selection of the mechanism equation. This approach will serve to eliminate many possible mechanism equations which do not fit and to bring the final selection down to two or three equations.

Initial rates alone are not sufficient evidence, however, to establish the mechanism or to evaluate the rate constants. The rates at finite values of conversion must also be used. There are several methods of using the rates at finite values of conversion. These will be discussed in next month's installment, Interpretation of Kinetic Data—II.

NEXT MONTH

We'll continue our discussion of how to interpret kinetic data and cover methods which use the reaction rates at finite values of conversion.

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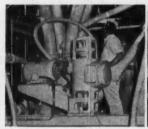
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The Plant Notebook Edited by Theodore R. Olive

Piping Material	Density, Lb./Cu.Ft.	Tensile Strength, Psi.	"Unit Weight," d/TS	Price, \$/Lb.	"Unit Price," U.W.x\$/Lb.
Steel and iron	480	40,000	0.012	0.09	0.001
Aluminum alloy	170	45,000	0.004	1.40	0.005
Copper	615	40,000	0.015	0.92	0.014
Rigid vinyl	84	7,000	0.012	1.60	0.019
	75	5,000	0.015	1.50	0.022
	107	5,000	0.021	1.10	0.023
	47	1,800	0.026	1.40	0.036
Polyester-glass fiber mat	97	16,000	0.006	2.00	0.012

* January Contest Prize Winner

Quick Comparison of Piping Materials

Carsten F. Boe

Professional Engineer, Malvern, Pa.

Here is a "quicky" method of comparing pressure piping materials according to weight and price. The method takes a minimum of calculation and you do not have to consider sizes and other details. Because it is so simple, it tends to ignore certain factors which may be important, but these can be taken into consideration readily, by applying a little judgment to the results, as discussed later.

• First you calculate a "unit weight" for 1 ft. of the piping material by dividing the density of the material, in Ib./cu. ft., by its tensile strength, in Ib./sq. in.

• Then you calculate a "unit price" for 1 ft. of the piping material. For this, get from your supplier the price per pound, or the price per foot for a few sizes, dividing this by the weight per foot. Multiply this price per pound by the "unit weight" found above.

As we shall see, what you have actually done in these two steps is to calculate the theoretical weight and price per foot of a pipe having a flow area of 1 sq. in., for a maximum working pressure (at 3.6 safety factor) of 20 psig. To compare the relative merits of several piping materials which have thus all been put on the same basis, you don't have to worry about these area and pressure limitations. However, if you are interested in the effect of flow area or operating pressure on the unit weight and prices, then you will find that these are directly proportional to the figures

you have already secured. That is, if you need a pressure five times higher, then the weights and prices will be five times higher. Also, if you need five times greater flow area, then again the unit weights and prices will be five times greater. And, if you need twice the safety factor (7.2 instead of 3.6), the weights and prices will be doubled.

These relations can be justified easily by a little manipulation of the stress formula for thin-walled pressure vessels, the so-called hoopstress formula:

$$S = pD/2t \tag{1}$$

The flow area is $A = 3.14 D^2/4$ and the weight per foot is approximately W = 3.14 dD t/144. Now we can eliminate D and t among these two expressions and Eq. (1), whence:

$$W = p A d/72 S \tag{2}$$

If we take the tensile strength as 3.6 times the working stress, or TS = 3.6 S, then W = p A d/20 TS. Letting A = 1 sq. in. and p = 20 psig., then:

"Unit Weight" =
$$d/TS$$
 (3)

"Unit price" =
$$(\$/lb.) d/TS$$
 (4)

The table above illustrates a few results you may get by this method. Note that the "unit prices" are illustrative only, since

NOMENCLATURE

- A Internal cross sectional area, s q. in
- d Density, lb./cu. ft.
- D Internal diameter, in.
- p Working pressure, psig.
- S Stress at working pressure, psi.

 t Pipe wall thickness, in.
- TS Tensile strength of material, psi.
- W Unit weight, lb./ft.

★ February Contest Prize Winner

"Process Delay Chart Spots the Bottlenecks in Batch Processes."

A prize of \$50 in cash will be awarded to A. R. Valdes, engineering department, Brown & Root, Inc., Houston, Tex. Mr. Valdes' scheme, useful wherever batch processes are used, will appear in the May issue.

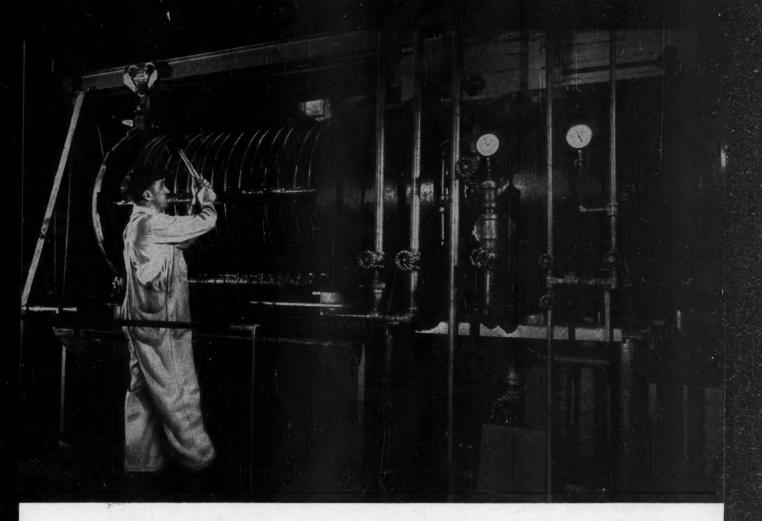
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you may be able to buy at different

prices per pound. Note too that this method slights certain properties that may be important and may call for use of judgment. For example, there is no allowance for corrosion, so that the picture may be too favorable for steel and other corrodable materials. Also, the more corrosion resistant materials may permit higher flow rates since they will better retain their flow area and low frictional characteristics. With the more resistant materials you may get by with a lesser flow area, which again makes the picture too favorable for steel and other materials of poor corrosion resistance. On the other hand, some of the plastic materials may have poor fatigue strength, poor temperature resistance with resultant lowering of tensile strength, etc. So, the picture may also be too favorable to these.

The table reveals some interesting things about these various materials. Aluminum is actually a very light material, whereas the plastics are not as light as many people believe. However, rigid vinyl does compare favorably with steel in this regard. And considering the various factors, the glassfiber-reinforced plastic appears to have a decided advantage over the thermoplastic pipes, from both the weight and the price standpoints.

This method has been found very helpful in making quick comparisons and evaluations of piping materials. Using tensile strength as a basis of comparison is often convenient, but it must be admitted that it may result in errors. A slight modification of the method, however, will overcome this difficulty.

In the modification we use the maximum allowable tensile stress, rather than the tensile strength, to calculate the "unit" weight and prices as above. The result will still apply to 1 ft. of pipe, of 1 sq. in. flow area, but now the maximum allowable working pressures will be 72 psig., rather than the 20 psig. allowed in using tensile strength.

The modified method is more accurate since, in effect, it permits you to use individual safety factors for each material, as desired, depending on other considerations than tensile strength.

This method has already been very helpful in evaluating the prospects for glass-fiber-reinforced pipe. The precaution of using allowable tensile stress, rather than the shorttime tensile strength, seems in this case to be particularly significant in view of test results under prolonged time exposures to wet conditions.

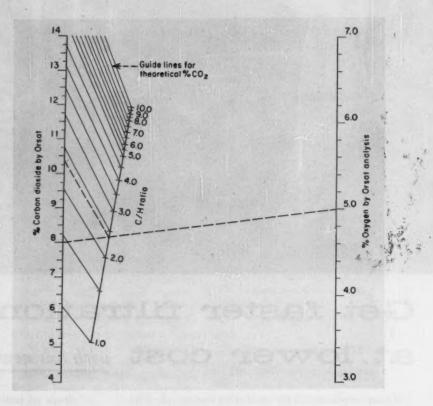


Chart Gives C/H Ratio of Fuels

William H. Decker

Chemical Engineer, Chicago 20, Ill.

Above is a nomograph which permits the quick determination of the carbon-hydrogen ratio of fuels when the Orsat analysis of the stack gas is available.

Knowledge of the carbon-hydrogen ratio is desirable since it can be used to find the gross heating value of the fuel from published data on liquid and gaseous fuels. Furthermore, from the gross heating value, the Orsat analysis and the stack temperature, the combustion efficiency can be found readily.

The nomograph does away with the need for calculation or timeconsuming laboratory analysis to fix the carbon-hydrogen ratio of the fuel. On this account it is especially useful for rapid field application. It is based on the assumption of pure fuels, since the effect of inerts or impurities is generally negligible. Scale ranges may be varied to fit any particular need.

To use the chart, connect the percentage CO_a and the percentage O_a values, as obtained from the Orsat analysis. The intersection of the line with the C/H ratio scale then gives the carbon-hydrogen ratio of the fuel burned. For ex-



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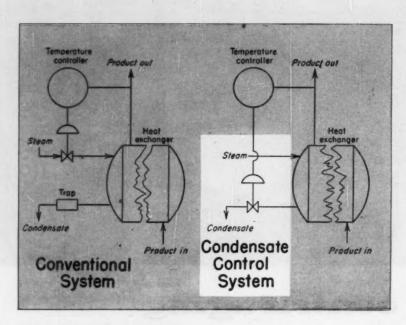
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Specialists in Liquid-Solids Separation

ample, 5% O₂ and 8% CO₂ means a 2.4 C/H ratio.

Shown on the chart is a series of guide lines connecting the C/H ratio scale with the percentage CO₂ scale. A line from any C/H ratio intersects the CO₂ scale at the

theoretical percentage CO₂ for that particular ratio. Thus, comparing the percentage CO₂ found by the analysis with the theoretical for the fuel being burned permits approximating the furnace or heater combustion efficiency.



Condensate Control Saves Capital Cost

E. M. Seagrave

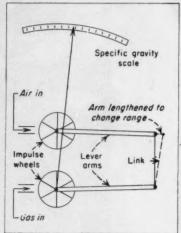
Staff Engineer, Celanese Corp. of America, Charlotte, N. C.

Shown above, compared with the conventional arrangement, is an unconventional but very useful method for the temperature control of a steam-liquid heat exchanger. The lefthand sketch illustrates the. usual hook-up. The temperature controller measures the temperature of the product leaving the heat exchanger and positions the control valve which regulates the steam flow to the exchanger. When the temperature drops, the valve opens automatically by an additional amount to bring the temperature of the product back to its desired

Where the steam supply pressure is nearly constant I have repeatedly and successfully used the arrangement shown at the right above. The valve now controls the con-

densate leaving the exchanger, rather than the steam. Here the system maintains the temperature by keeping the exchanger coils partly flooded. It increases or decreases the effective heat exchange area as required. In this way it is possible to control over wider load changes than with the conventional method.

Another advantage is that the saving in capital investment is considerable. Suppose that an application using the conventional arrangement required a 6-in. control valve. To control the same flow rate in the condensate line a 1-in. valve would suffice. Furthermore, the same reduction applies to the bypass valves, and there is no need for a steam trap in the condensate control arrangement.



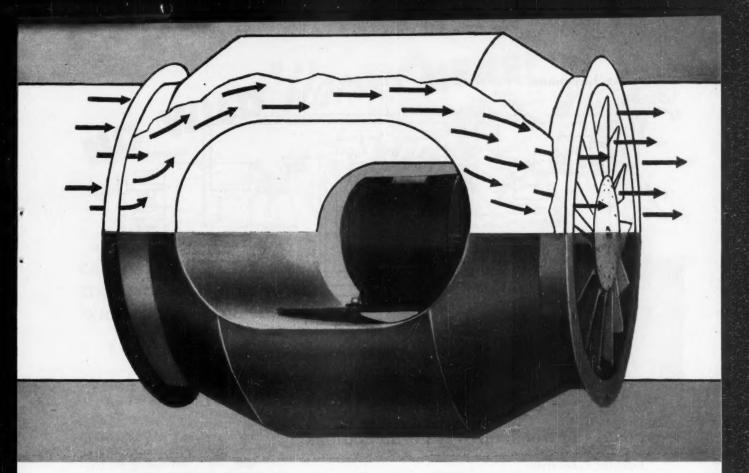
How We Changed Range Of a Gas Density Meter Milton Kaplan

Chemical Engineer, Great Lakes Carbon Corp., Morton Grove, Ill.

We have a Ranarex specific gravity meter which originally had a range of 0.30 to 1.3. We wanted to use it to measure the gravity of a coke oven gas whose density varied between 0.20 and 0.45. Therefore, we cast about for a simple and inexpensive way of changing range.

The Ranarex instrument measures specific gravity of a gas by comparing it with air at the same temperature, pressure and humidity. The test gas and the air are each driven by motor-driven fans against the blades of separate impulse wheels. The momentum of each gas exerts a torque against the shaft of its impulse wheel, which is a function of the gas density. Since the impulse wheels are connected together externally by lever arms and a mechanical linkage, and their torques are opposing, a certain balance point will be achieved for each test gas density. Changing the length of one lever arm will change the balance point.

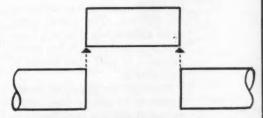
Therefore, we extended the length of the air impulse wheel lever arm by about ½ in., which dropped the instrument's range about 0.3 specific gravity units. The instrument was recalibrated using helium, methane and city gas as standards, and this calibration has not changed in several months use.



Bifurcator Fan installs right in duct . . . to exhaust hot, corrosive, flammable, fumes

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The Bifurcator is an axial-flow fan in a divided housing. Fumes bypass the motor which stays cool, clean and easy to inspect or maintain. Bifurcators can be constructed of cold rolled steel, stainless steel, rubber covered steel, monel metal, and many other corrosion-resistant materials. They can also be coated with Heresite, Ucilon, Tamanite, Herecrol R-9 sprayed synthetic rubber and other coatings. Bifurcators are available with fan wheels from 12" to 48" in diameter, with exhaust capacities up to 45,000 CFM. Send now for free catalog.



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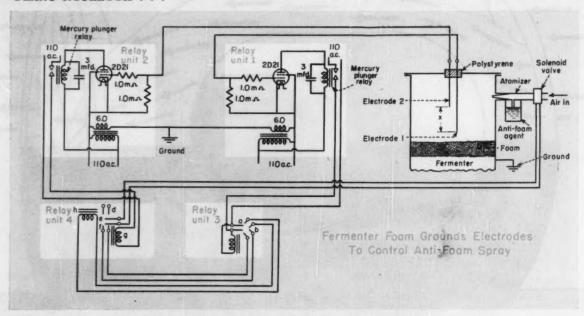
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Foam Control Improves Fermentations

Joachim Echevarria

Chemical Technologist, New Orleans, La.

In experimental laboratories and pilot plants, as well as in industrial fermentation investigations, the control of foaming is an ever-present problem. The sketch above shows a satisfactory automatic foam control apparatus which has proven successful in pilot plant studies of fermentation.

Although the apparatus shown appears to be unduly complicated, its complexity has been found to be justified by the results, since it performs better than other devices, such as time-delay relays and photocells. It makes use of electronic relays, thereby allowing a flow of control power of as little as 15 micro-watts from the electrodes to ground to open and close the biasing circuits to the tube grids.

In addition to the foam atomizer and the fermenter, the apparatus consists essentially of four units, which are indicated boxed within the unshaded areas. Units 1 and 2 are electronic relays which close circuits when electrodes 1 and 2, respectively, are grounded by the rising foam in the fermenter. Unit 3 is a double-pole, double-throw,

general-purpose magnetic relay, and unit 4 is a double-pole, double-throw latching relay. The components of units 1 and 2 are shown for those who may wish to assemble their own electronic relays. In each of these the mercury plunger relays are normally open.

When foam rises in the fermenter so as to ground electrode 1, relay unit 1 closes but does not provide current to the atomizer solenoid valve. As the foam continues to rise so as to ground electrode 2, relay unit 2 also is closed and the atomizer solenoid valve is energized, permitting compressed air to spray anti-foam agent into the fermenting chamber. When the anti-foam agent has caused the foam to subside, so as to break the electrical contact with electrode 2, the latch of relay unit 4 holds and anti-foam agent continues to spray. However, when the foam has dropped below electrode 1, then the latch of relay unit 4 is released, the solenoid valve is de-energized and the anti-foam spray is stopped.

In more detail, contact of the foam with electrode 1 closes the

mercury plunger relay of unit 1, thus breaking the contact at a in relay unit 3, and making the contact at b. This applies potential to relay unit 4 and contacts f. When the foam makes contact with electrode 2, the mercury plunger relay in unit 2 is closed, energizing magnet g in relay unit 4, and making contact between f and e. Member d latches e in position. This activates the solenoid valve and starts the anti-foam spray. When the foam falls out of contact with electrode 2, current ceases to flow to magnet g, but since member d latches e into position, f and e remain in contact and the anti-foam spray continues.

Finally, when the foam has subsided so far as to break contact with electrode 1, contact b is broken and contact a is completed, thus energizing magnet h and unlatching d. This breaks the contact of e and f, closing the solenoid valve and stopping the anti-foam spray. Relays 3 and 4 are now in their initial positions, ready to repeat the cycle when the foam again builds up.

The distance x, defining the difference in elevation between the two electrodes, is adjusted so that the solenoid valve will be energized long enough to introduce sufficient anti-foam spray to suppress the foam formation in 15 to 20 min.



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"ONVENTIONAL "brute force" vibrating conveyors use up to 90% of their power output to operate their own moving parts. By their very nature, they bear the seeds of their own destruction. Yet, until the development of Carrier Natural-Frequency Conveyors, it was necessary to "pay the price" -in excessive power costs, maintenance and down-time - in order to utilize the advantages of vibrating conveyors. It is necessary no longer.

Carrier Natural-Frequency Conveyors substitute the natural resonant action of coil springs for brute force. These amazing conveyors require only a very small motor to vibrate the pans in the natural frequency of the springs.

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A special Carrier Natural-Frequency Conveyor with %" pan, 27" wide, bringing crushed stone (6" lumps to fines) from

to grade, in a refractory plant. Surge loads 75 to 100 tons per hour, up a 7° grade.

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Blue color shows how glass lining extends up into the unit... past tight-sealing carbon insert. No contaminating material can enter the vessel.

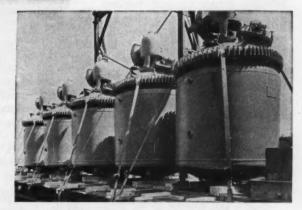
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You and Your Job Edited by Hugh T. Sharp

Write Better — and You Will Publish More

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- · Use these tested techniques.
- · Build your prestige, make money.

JAY R. GOULD

Today's engineer is a relatively untapped reservoir of information interesting to people outside of his specialized field. He possesses a fund of knowledge that a great many people want to know about—and that some will pay good money for. His potential audience ranges all the way from his fellow engineers to the readers of general magazines.

For the past ten years there has been a great demand for the engineer-writer who can not only bring specialized material to others in that field, but who can also translate it for other readers, both technical and nontechnical. Such flexibility has a high market value.

Engineer First, Writer Second

The average engineer, however, may say that he is an engineer first and a writer second. Perhaps that is your reaction at this point. But if you will take stock of your professional duties you may find that writing is second—not third or fourth. And the engineer who wants to get ahead often finds that a considerable amount of his time is devoted to writing—not only for his colleagues, but also for less technical readers and, in many cases,

JAY R. GOULD is professor of English and director of the Technical Writers' Institute of Rensselaer Polytechnic Institute. In an earlier article (CHEM. ENG., July 1954, p. 250), he turned a spotlight on many of the weaknesses in on-the-job technical writing and pointed to ways to correct them. We've invited him back to help you do a better job when you write for publication.

wherever the promotion department of his company can place his articles.

Whatever the reason, we are back to the same problem: How can technical information be transformed into more popularized forms than reports and research articles? Are there any devices, any tricks of the trade, which can be developed and which you can use easily?

I think that there are techniques, and it's on this assumption that I'm offering these points of adaptation against which you can check your writing. Three of them govern how you prepare your material, the others deal more directly with how you write. If followed they'll help you do a better job.

• Approach Your Material Properly

Where will your article appear? Who'll be reading it? What will you tell the reader?

Many periodicals accept technical material, but each has its point of view and its particular group of readers. You'll have to decide on the group you wish to reach. I have found it useful to divide the magazine market into three categories.

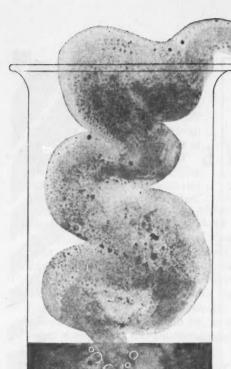
First of all, there are the publications sponsored by the professional societies. You undoubtedly subscribe to one of these and can supply its name. But a couple of examples come to my mind: the SAE Journal, put out by the Society of Automotive Engineers, and The Journal of Chemical Education. Readers of either of these magazines approach it as specialists. Generally, they are well acquainted with the background of any article in it.

The question may arise then: Why must you be particular as to the way you write for a professional magazine? Because even here you do not have a captive audience. Your fellow engineers are under no obligation to read what you write. Engineers are people; they don't like to be bored more than anyone else. Even the most technically

minded will benefit by easy-to-read language.

Closely allied to the professional magazines are the technical magazines. To name a few of them is to scratch only the surface: Product Engineering, Machinery, Machine Design, Aero Digest. Each phase of business and industry is represented by several of these commercially-published magazines. And because of this, they require a different type of material. For their readers read not only for information, but also to find out how it can be used. They are manufacturers and executives as well as engineers like yourself.

Then come the more general magazines. Here the engineerwriter is directing his matter to the widest reading public possible. Not only is he competing with other writers of factual information, he may be in direct competition with the story writer. He may aim at the Scientific American or the Yale Review with their particular readers. Or he may try the large circulation magazines like the Saturday Evening Post, Collier's, and Holiday. These publications are increasing their listings of non-fiction, and especially non-fiction of a technical nature. Though they are big time, they will accept articles from

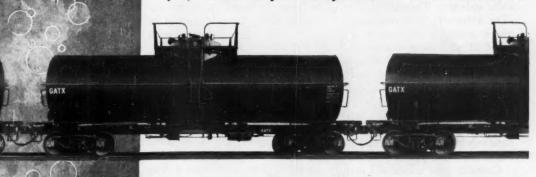


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engineers and scientists-if the material is well-presented.

But whatever your choice, realize that you will be within an area of communication. It will condition what you say and how you say it.

Who Is Your Reader?

Deciding on the area of communication is not enough; you should take a definite attitude toward your reader. Estimate how much he is likely to know, and how much he is capable of absorbing. Don't write in a vacuum.

An article for a chemical magazine starts one of its internal paragraphs this way: "Determine sinking times in triplicate or until consistent values are obtained." This is an expert on wetting agents talking to people who can directly use his information. There is no nonsense here. The author gets right down to cases. He states the facts and apparently feels that the reader needs no further explanation.

I have lifted another sentence or two out of a magazine devoted to promotional material. The article is more leisurely and more tactful because the appeal is to a wider audience. The excerpt says: "The automatic transmission is a case in point. It was born on account of an ornery characteristic of internal combustion engines. They refuse to generate much torque until they are going fast. Torque is the twist imparted to the crankshaft by the pistons." The language in this sample is comparatively simple; the sentences are short; the word torque is defined.

Consider your reader and cultivate a certain know-how in your relations with him. Be tactful and courteous, and especially be understanding of the gaps in his knowledge.

What Are You Going to Say?

How much ground are you going to cover in your article? In general, the less technical the article is, the longer it will be. Or to put it in reverse, if your popularized treatment is to occupy a space similar to the technical article, you will have to cut out some of the technicalities.

Pick the Right Spot

Soon after deciding to write for possible publication you meet the problem of selecting the proper environment, the correct magazine, for your article. Your choice will depend on:

- Who reads it?
- How many read it?
- · Why is it read?
- How is it read?

Often you can get the answers by reading an issue or two of a magazine with these questions in mind. For the first two particularly, you could write the publication and ask for a copy of the circulation breakdown prepared by the Audit Bureau of Circulation. This list classifies subscribers by job titles.

Once you've answered these questions you'll do a better job of preparing your article.

Why is this? Because the more general the reader, the more time he must be given to digest unfamiliar data. Not only must he be given more time, but your main points should be repeated and dramatized. If you feel that your reader won't understand a certain section, eliminate it if you can. Present your ideas in broad statements and minimize any exceptions to the rules.

The amount of space you use will be conditioned by how much you dramatize your ideas. Suppose that your original material is in the form of a report or a research article. Although it may have performed its original function well, to the new reader it is likely to be tiresome and dull. Statistics, for example, are skipped by the ordinary person. To say that a trillion dollars were spent in a certain phase of the last war, as one of my students did in a recent speech, meant very little to us. But when he dramatized his statement and told us how many schools that money would build, then we sat up and took notice. And his illustration took more time to give than did the bare statistics.

A professional writer knows that the written word is often not enough. He must supply pictures. We cannot always supply photographs to support our statements, but we can supply word pictures, and they are the next best thing.

• Use These Tested Techniques

How to attract readers How to keep them reading How to edit your material

You are ready now to get down to the actual writing, to put your technical knowledge into a form where many people will enjoy reading it. What devices can be used?

First of all, take special care with your beginnings. The more removed the reader is from you, the less he feels compelled to read what you have written. If you feel that you must have something called an introduction, by all means write one. But later on, when revising, see if you can't cut it off.

Expert writers know how very important the opening paragraphs can be. Elizabeth Ogg, a professional writer specializing in interpreting technical material for the layman, says this. "Beginnings are strategic. They may make a difference in whether your writings are read or passed by."

What will lure a reader to read you through? It may be a story you tell, an incident you have been involved in, something lifted from today's newspaper, a statement that invites contradiction. And sometimes you will have to invent the opening? Does this shock you? It shouldn't if you will recall that fiction is invented, yet it often presents life better than does the real thing.

Whatever kind of beginning you use, make it compatable with the topic it introduces. The sober, factual, impersonal beginning of the report is not suited to the general article. And a sensational be-



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All K & M diaphragm Control Valves have a drawn steel diaphragm casing able to withstand extreme heat, impact, pressure and shock... and a cast steel open yoke that retains its strength when the heat is on. When something goes wrong, the difference between safety and danger might very well be this all steel construction.

Further, consider the everyday advantages of the all steel K & M construction: One man can move the smaller size valves without hoists, for the K & M steel topworks weighs only half as much as other topworks of equal size. The open yoke, provided in cast steel by only K & M, assures accessibility and completely eliminates any possible accumulation of gas, vapor or condensate.

More linear . . . more accurate . . . more responsive

The K & M molded neoprene diaphragm provides a large effective area which is constant throughout the long stem travel. Thus, K & M Diaphragm Motors provide maximum linearity in stem movement and virtually the highest power factor available. Operating with high capacity, low turbulence K & M valve bodies, these motors mean more accurate, more responsive flow regulation.



ginning may not be appropriate to a certain type of magazine.

An article from a technical publication uses the historical approach, with people, places, and dates. It says: "Beneath the University of Chicago's West Stands, on December 2, 1942, Enrico Fermi and his co-workers successfully operated the world's first nuclear reactor. Thus a device that would produce neutrons by a self-sustaining chain reaction became a reality."

And a technical magazine with a broader reading public contains a piece that begins in this way: "Curiosity to know more about living things of the earth has teased man's mind for centuries, and men and children of our own time are no exceptions." A beginning built on contrast, in no way sensational, yet quite suitable for a natural history subject.

Take particular pains with your beginning, then, make it agree with your readers and your material.

Personalize Your Writing

In another talk I heard, this on Veterans Day, the speaker was giving us inspiring principles, but they were generalizations, ideas without much force or substance. Many in the audience were obviously bored. They had heard it so many times before.

Then suddenly the speaker pointed to us and commanded us to follow him back into the war years. He recounted some of the experiences he had had as a soldier in Europe. He told us what impressions he had received, what he himself had gone through. The speech came alive because the speaker had put himself into it. We could see him in action; the material of the speech was not new but the story he told was different because it revealed him in action. He had given life to his words.

The reading public, too, is interested in action. Put yourself into the picture if you possibly can. If you are talking about a design that has been perfected, tell how you yourself did it. Show that your writing has been done by a man, not a machine. Don't be overly modest; you're the expert.

NEXT MONTH ...

What does an engineer have to learn to equip himself for a job in management? Where do most engineers in management fail? How can you avoid the stumbling blocks? These and other facets of executive development will be the subject of next month's You and Your Job.

Involve yourself in what you are writing.

Don't Stray From Your Theme

The next point I would make concerns any writing you do, not only adaptation. Stick to your subject. The advice I gave your earlier, about devising examples to enliven your writing, may, if uncontrolled, work to your disadvantage. You can strive so hard to develop the pungent phrase, the live story, that you can overload your article.

Side paths are usually attractive; side issues too. Regardless of the pleasure you may get from exhaustively discussing some minor point, or going off on a tangent, stick to your subject.

Edit Your Material

Somewhat in line with what I have just been discussing is my next point. Edit yourself. This is one of the hardest tasks a writer has to do, to be objective enough to see his writing as the reader does. Look at the vocabulary you use and think of it in these terms:

1. Do your words actually say what you want them to say? People who work exclusively in one field often find that they use phrases that have lost a good deal of their meaning. Do you say such things as: "However, there is one feature which is of outstanding distinction," when you mean, "One feature stands out?"

2. Are your words vital? Reading recently that Ernest Hemingway had won the Nobel prize, I was reminded that as a novice Hemingway was told by the experts to eliminate adjectives from his work,

to use virile verb forms, to scratch out the abstractions. Adjectives can be powerful when they are used sparingly; we can't get along without nouns; but it is the verbs which bring writing to life. They are action words. "The measurement of a cylinder was effected" is certainly a weak combination when compared with "The cylinder was measured."

3. The more you write about similar subjects, the more likely you are to use similar word patterns. You will find some in this article. But trite and hackneyed words make your writing colorless. See if you can't simplify such a selection as "The business field is open; from the standpoint of the investor the financial future is good."

Next, look at the over-all construction of your piece.

Your writing cannot be most efficient if it isn't built up on some consistent scheme of paragraphing. Many authorities will tell you to use short paragraphs as if they could be measured by so many words. This is not so. The paragraph is a unit of thought. Not all paragraphs are alike; they have different functions. Here are a couple of examples.

In technical writing, and in writing where you are trying to get across definite information, a good paragraph form to use is the topic paragraph. In this, a statement is introduced. The rest of the paragraph analyzes that statement, examines it from various points of view. When you feel that the beginning has been adequately explained, you end the paragraph.

Another type is the illustration paragraph. Again, you may start with a declarative statement. But in this type you follow through with examples to clarify what you said at the beginning. When you have provided adequate illustration, then you have come to the end of your paragraph.

These are only two methods of paragraphing. Others can be used to fit other circumstances.

End Strong

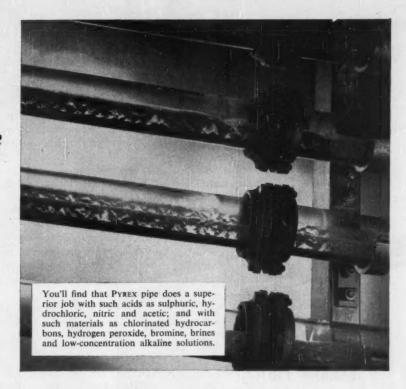
The last item in our check list is appropriately enough the ending.

Are you missing the corrosion resistance of PYREX[®] pipe because you think it will break?

One plant manager describes his experience with PYREX pipe this way: "There was no breakage during installation. There have been no lines broken because of the product handled, the temperatures involved, or the age of the pipe. There has been no accidental breakage. In short—there has been no breakage."

Every "product" line in this manager's plant has been PYREX pipe since 1943. The company switched to PYREX pipe because metal lines were quickly corroded by product acids. Corrosion in the metal piping also made cleaning difficult. Frequent replacements made maintenance very costly.

Engineers and operating men in hundreds of processing plants make similar "no breakage" reports about millions of feet of Pyrex brand glass piping in use today. If you are not enjoying the trouble-free corrosion resistance of Pyrex pipe because you are worried about breakage, why not talk to people who use it daily. We shall be pleased to furnish names.



You can install it easily

Over 75% of the PYREX pipe now in use has been installed by our customers' own pipe fitters. It is easier to hang than many other kinds of corrosion resistant pipe. There are no special hard-to-catch-onto tricks about it. Our installation manual covering every detail is yours for the asking.

Now more durable

To offset strain, all Pyrex pipe ends and fittings (except U-bends) are now tempered, which makes them much stronger than annealed fittings. They are strong enough to drive nails with.

Cuts maintenance problems

The liquid-smooth surface of Pyrex pipe does not pit. It stays cleaner longer. When cleaning is necessary, it is easy; for you can see the interior

of the pipe at all times.

One plant superintendent said, "Since Pyrex pipe was installed for all of our product lines, maintenance has been practically nil."

What does it cost?

Initial cost of Pyrex pipe compares favorably with most other corrosion resistant piping . . . is lower than some. Low installation and maintenance cost and long-time service put Pyrex pipe far on the economy side of your plant budget.

More information for you

For more information to help you judge the advantages of PYREX pipe, let us send you any or all of the bulletins listed in the coupon below. Or, if you prefer to discuss your own specific problem immediately with one of our representatives, write, wire or phone us.



CORNING GLASS WORKS, CORNING, N. Y.

Corning means research in Glass

CORNING GLASS WORKS, 14 Crystal Street, Corning, N. Y.	the ten age. One distinct total a fig-
Please send me the bulletins checked below:	Name Title
☐ EA-1: "PYREX brand glass pipe in the Process Industries" (Illustrated case histories)	Company
☐ EA-3: "PYREX brand 'Double-Tough' Glass Pipe and Fittings" ☐ PE-3: "Installation Manual for PYREX brand 'Double-Tough'	Street
Glass Pipe" Please have your representative call on me.	City Zone State

End on a strong note. You invited the reader to read; leave him with the feeling that he has accomplished something. This feeling can be achieved in a number of ways.

If you began with a story, end with a story. If you started with a provocative statement, end with one that has a lift to it, that doesn't run down. Make some demands on your reader. If nothing else, ask him to think of the ideas you have presented. One way is to provide him with a summary or a glimpse into the future.

Such an ending is this one taken from a recent survey on automatic controls in machinery. "This is a tremendous challenge. It is a challenge that will be met only by freeing ourselves from the brake of manual control. When the machine on the production line of the future can set its own pace of operation, the productivity of industry may be governed only by human need."

Summing Up

As the ending for my article, I shall use the summary technique. In directing your writing to a wider public, check your writing at these nine important points. They are:

 Consider the kinds of readers you are writing for and type of publication in which your article will appear.

· Think actively of your reader

-determine how much he knows of your subject.

 Decide how much ground you will cover.

• Pay particular attention to your beginnings.

 Put yourself into the picture if you possibly can.

· Stick to your subject.

 Edit yourself and especially examine the vocabulary you use.

 Consider the over-all construction of your article.

• End on a strong note.

No one can guarantee a magic formula for adapting technical material. But these nine check points will carry you a long way in making others read what you have written.

SALARY PROGRESS ... For First Five Years

The typical 1949 engineering graduate nearly doubled his starting salary in the five years since he left school.

In a recent survey* 71 companies reported that the average monthly salary of fresh-from-college engineers was \$270 in 1949. Yearly raises of almost \$50 per month have now boosted their average monthy rate to \$513.

In 1949, engineers as a group were the highest paid of the new graduates. Graduates who went into sales made less to start (\$254), but in the five years which have elapsed they have passed the engineers and now earn a monthly average of \$547.

A survey sidelight is of interest. All of the cooperating companies were asked to trace the salary experience of the 1949 recruit deemed to have the greatest potential to advance into top management. Of 97 companies which answered this request, 48 picked engineers, 28 selected commerce graduates and 21 selected liberal arts men.

Average monthly starting salaries for those tabbed as "comers" went like this: Engineers, \$274; commerce, \$263; arts, \$254. Five years later the arts graduates were far ahead. Present average monthly rates are: Engineers, \$607; commerce, \$666; arts, \$679.

TANGIBLE INCENTIVE

. . . To Study Engineering

At the recent Military-Industrial Conference in Chicago, an impressive array of experts spoke on the vital needs of both the services and industry for the nation's limited supply of technical men.

They cited an equally impressive array of statistics showing how acute today's shortage is and predicting the terrific pinch that will come in any future period of national emergency. The experts leveled their fire at two causes—current selective service and reserve practices and a drop in the quality of American education, resulting in fewer students qualified for and interested in technical careers.

Present military service practices were scored as "wasteful" and "unrealistic." But, at the same time the military's need for technical men was acknowledged.

Several speakers told of the drop in the percentage of high school students qualified to study engineering and science, and of an apparent lack of interest—attributing this to the need for better qualified high school teachers of math and science. One speaker added another reason. Said Lt. Gen. (Ret.) Leslie R. Groves: "What tangible incentive is there for a boy to be an engineer under an economic system which 35 yr. after their graduation provides the average plasterer with greater accumulated earnings than those of the average civil engineer."

FOR GRADUATES ... A Job Directory

Today's newly graduated chemical engineer has little trouble finding a job. But to help him learn just what jobs are available and with whom, a new annual publication, Engineers' Job Directory, has just been published.

According to the publishers, Decision Inc. of Cincinnati, Ohio, the new directory is designed to help individual companies put their job story before the graduate. It aims to give him information ranging from the company's size and industry to the name and address of the person to contact for a job. Locations of company plants, research laboratories and offices are listed and indexed by cities and states.

The directory also lists companies interested in undergraduates for summer jobs.

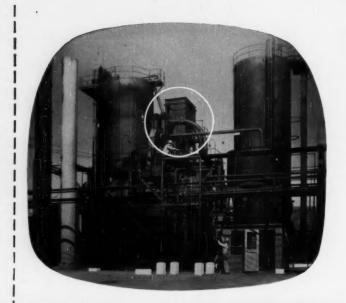
Conducted by Dr. Frank S. Endicott, Northwestern University, Evanston, Ill.

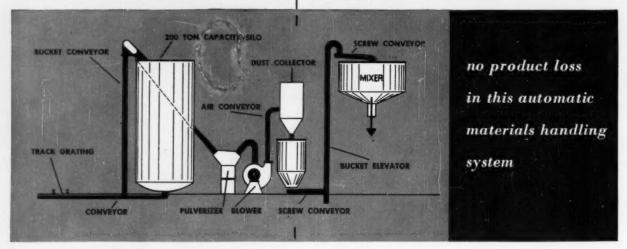


Efficiency of WHEELABRATOR® collector provides

dust-free handling of talc and coal

For Koppers Co., Inc.





When Koppers Co., Inc., built their new Fontana, Cal. plant for producing tar-base, pipe-line coatings, a Wheelabrator Dustube cloth-tube type collector was selected on the basis of its high efficiency for controlling and recovering the dust created in the materials handling system.

The handling system, controlled by push buttons, conveys the dry materials . . . coal and talc . . . from railroad cars or trucks to a storage silo through the pulverizer, into the weigh hopper and then into the mixer. Dust in the process is reduced to a negligible amount through use of totally enclosed conveyors and a Wheelabrator Dustube Collector which traps all of the fine material and empties into the weigh hopper. As a result, volume production is achieved without product loss because all material is confined in

the handling system.

The high efficiency product recovery of this installation is typical of the performance of the Wheelabrator Dustube Collector in thousands of plants. Each installation is individually engineered for the particular job. Wheelabrator engineers are ready at all times to develop the best filtration system for your problem. Write today for Catalog 372 for full details.

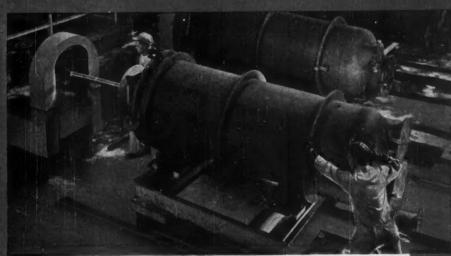


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ALCOPLATE*

Chemically Plates any Metal Surface with Protective Nickel



Solves Corrosion Problems in the Chemical, Petrochemical and Related Industries At Low Cost

No matter how intricate the geometries involved-on surfaces impossible to nvoived—on surfaces impossible to plate electrolytically or to clad—plate electrolytically or to clad—of protective nickel. Applied to inof protective nickel. Applied to inexpensive base metals, its corrosion resistance is as good as or better than pure or wrought nickel or other coulty allows. or wrought nickel or other costly alloys. It will pay for itself many times over through prolonged life of process equip-

Other important advantages of ALCO-

1. Maximum protection at minimum plating coat—Zero porosity is obtained in plating coats of less than a half mil (.0005).

2. Plate adhesion is excellent—Steel speci-

mens pulled to the yield point show no flaking or spalling.

3. Plate thickness is uniform—Costly over-plating is eliminated because ALCOPLATE deposits vary less than 10 per cent from specifications on any surface.

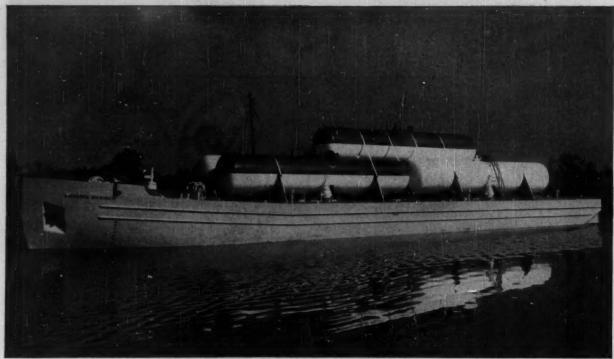
4. Resistance to abrasion—Hardness averages 48 Rockwell C and can be increased to 66 Rockwell C through post-plate heat

5. Appearance of plate—A polished appearance can be obtained by polishing the base metal prior to plating. ALCOPLATE can be buffed to a high luster.

Learn how ALCOPLATE can solve your corro-Learn now ALCOPLATE can solve your corro-sion or product contamination problems. Details on the application of ALCOPLATE to your needs can be obtained from any of the ALCO sales offices listed below.

ALCO

AMERICAN LOCOMOTIVE COMPANY



Built for Tidewater-Shaver Barge Lines, the Ammonia Mariner will be used to transport anhydrous ammonia from Shell Chemical Corporation's Pittsburg, Calif., plant to the Pacific Northwest. The two-color deck tanks are for permanent installation on a Columbia River barge.

Anhydrous Ammonia Barge AMMONIA MARINER

* Largest seagoing barge ever constructed for the bulk transportation of liquid anhydrous ammonia under pressure. Meets requirements of U. S. Coast Guard and American Bureau of Shipping for unlimited ocean service.

* Length 252 feet, beam 48 feet, depth 18 feet. Liquid cargo capacity approximately 721,270 U. S. gallons. Cargo carried in seven underdeck and two on-deck tanks designed for a working pressure of 250 PSIG. Deck accommodations for two additional tanks 82'-6" x 13'-8½".

* Features maximum towing efficiency and maneuverability. Ship-shape bow and notched after-end for easy towing or pushing. Deck gear includes two 5,100 lb anchors recessed in bow pockets and hand-operated anchor windlass accommodating 240 fathoms of chain.

* Longitudinally and transversely framed for maximum ruggedness. Pressure vessels supported on steel saddles and secured by specially designed chocks to prevent longitudinal movement. All external piping is seamless steel, hot dipped, galvanized on the outside only, and mounted in lead line hangers.

* Air-operated control system permits speedy and simultaneous closing of liquid and vapor valves either from barge stations or dock. Individual controls, gauges and dials for each pressure vessel.

For the economical, dependable and safe waterborne transportation of any chemical product, it may be to your advantage to consult Bethlehem at Beaumont.

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Write for literature!

IMPERVIOUS GRAPHITE PROCESS EQUIPMENT?

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Cascade Coolers

HCI Abi

Resistance of Plastics and Rubbers to Various Reagents

Material	Acids, Weak	Acids, Strong	Alkalis, Weak	Alkalis, Strong	Alcohols	Ketones	Esters	Hydro- carbons, Aromatic	Hydro- carbons, Aliphatic
Acrylate and methacrylate resin	E	E—except oxidizing	E	E	Sw or Di	D	D	Di	G
Casein	G	De	So	De	G	G	G	G	G
Cellulose acetate	F	De	F	De	Sx	Sx	Sx	G	G
Cellulose acetate butyrate	F	De	F	De	P	Sx	Sx	0000	999
Cellulose nitrate	F-G	P in oxid.	F-G	De	Sx	Sx	Sx	G	G
Ethyl cellulose	F-G	P	G	G	F	F	P	P	G
Halide polymers, polyvinyl linkages	G, ng in glac. acetic	G-D; ng in fum. HNO: or ag. reg. G		P	D	Sx	Sx	Sx	Sx
Melamine formaldehyde	E	G-De	G-E	G-E	E	E	E	E	E
Phenol formaldehyde	G	D	G-P-D	De	000	E	E	E	E E G P
Phenol furfural (filled)		De	G	De	G	E	E	E	E
Polyamide resin	FPEEE	P	G	G	G	E	E	G	G
Polyester resin	F	P-G	P-G	P	P	P	P	P	P
Polyethylene	F	E	E	F	G	P	P	P	P
Polystyrene	Ē	G	E	E	E	E	Sw	Sx	F-G
Polyvinyl acetals (unfilled)	P	P	E	G	F-Sx	Sw	Sw	Sw	D
Polyvinyl acetate	G	P	E	P	Sx	Sx	Sx	Sx	E
Polyvinyl chloride	E	G-E	E	G-E	D	Sx	Sx	P-Sw	D
Rubber derivatives	E	E	E	E	E	P	P	P	G
Rubber-pure gum	Ğ	G	G	D	G	G	F	D	D
Rubbers-synthetic	F	P-G	G	F-P	G-P	P	D-F	D-F	D-F
	E	E	E	E	E	E	E	E	E
Tetrafluoroethylene		De	D	-	G-E	G-E	G-E	E	E
Urea formaldehyde	G		E	-				P-Sw	E
Vinyl chloride-acetate copoly- mer	E	E	E	E	E	D-Di	P-Di		
Vinylidene chloride	E	G-E	G, ng in NH:	G, ng in NHs	E	G	G	G	E

D Depends Di Dissolves F Fair P Poor Sw Swells Ng No good De Decomposes E Excellent G Good So Softens Sx Soluble

Organic Materials for Radiochemical Uses

Resistance to radiation, chemicals, and temperature are criteria for selection. Plastics are more easily decontaminated than other materials, so are often best.

J. F. BENNETT

J. F. Bennett is with the University of California Radiation Laboratory, Berkeley, Calif. Information in this article was obtained from actual tests at the laboratory and portions of it were abstracted from the literature.

Vastly increased rise of radiochemicals in chemical processing and elsewhere creates the problem of what materials to use with them. The organics are frequently suitable if intelligently selected.

Plastics are generally more easily

decontaminated than other materials. Polyethylene is one of the most easily decontaminated. Polished stainless steel is only fair.

Ionizing radiation produces changes in organic materials by breaking the chemical bonds between atoms. If the broken bond is in the main polymer chain, chain cleavage results.

The more impure plastics (those that contain varying amounts of fillers, plasticizers, halides, sulfur

For the toughest service!

(for hot, concentrated sulfuric acid and other corrosives too severe for the stainless alloys)



THE DURIRON COMPANY, Inc.
Dayton 1, Ohio



Write for Bulletin V/8

Meterial	Softening Point, °C.	Thermal Expansion Per °C. ×10 ⁻⁵	Th rmal Conductivity Cal./Sec. Cm. °C, × 10 ⁻⁴	Heat Distor- tion, °C
Acrylate and methacrylate resin	66-193	9	1-10	50-85
Casein	94	4.1-6.8		149
Cellulose acetate	60-120	5-16	4.5-8.7	50-100
Cellulose acetate butyrate	60-127	11-17	4-8	47-109
Cellulose nitrate	60-90	6.5-16	3.1-5.5	43-66
Ethyl cellulose	93-135	10-14	3.8-6.3	45-93
Halide polymers, polyvinyl link-		S. S		
ages	210			
Melamine formaldehyde		1.5-4.0	8-20	115-160
Phenol formaldehyde		1.5-4.0	5-20	115-160
Phenol furfural (filled)	thars 204-290	2-4.5	3.5-20	139-146
	400 approx.	5.5†	1.7	115-150
Polyester resin		8.0-10.0	4	140-400
Polyethylene	224*	9†	2.3	107*
Polystyrene	88-121	6-8	1.9-3.2	73-88
olyvinyl acetals (unfilled)	47-200	7.8-22.3	3.4-4.4	47-100
olyvinyl acetate	65-175	8.6	3.8	40-50
olyvinyl chloride	*******	7-25	3.9-4.0	77-121
lubber derivatives	75-110	7-13	2.6-3.0	60-105
lubber-pure gum			3.9	
Subbers-synthetic			4.6-4.9	
etrafluoroethylene	100*approx.	5.5†	1.7	140*
Jrea formaldehyde		2.5-3.0	7.1	127-130
Vinyl chloride-acetate copoly-	AND THE REAL PROPERTY.		Maria Cara	

60-65

116-138

† Per °F.

• °F.

compounds, etc.) have the least resistance to radiation damage.

Vinylidene chloride. .

In general, the harder the plastic the more resistant it is to radiation damage. Plastics tend to become more brittle and retain their tensile strength. Rubbers become harder and lose their elasticity and tensile strength. Irradiation increases the specific gravity of the elastomers that are hardened, and decreases the specific gravity of the elastomers that are softened.

There is no correlation between radiation damage suffered by organic materials and their resistance to chemical reagents and (or) their optimum temperature range.

Radiation Damage

Plastics—Plastic materials suffer radiation damage principally by ionization and chain cleavage. That is to say, if the broken bonds are between carbon atoms of the main chain and attached side atoms or groups that are not connected directly in the main chain, either unsaturation or cross-linking between adjacent polymer chains may result

3.5-4.1

66-82

· °F.

Those plastics which have a low initial specific resistance (10³⁰ to 10³¹ ohm-cm.) show little relative change on irradiation. Plastics with a high initial resistivity (greater than 10³¹ ohm-cm.) may show an appreciable change on irradiation. For example, Lucite and polystyrene without plasticizer retain their high resistance. Saran, which does contain plasticizer, shows considerable change in resistivity.

With most materials, irradiations in oxygen and in helium gas give similar changes. An exception is stretched rubber, which shows more damage in oxygen because of ozone attack.¹

In polyethylene that has the structure of the unsubstituted paraffin chain, (CH₂)_a, cross-linking

rather than chain cleavage is the predominant process. This is evidenced by increases in hardness, tensile strength, and density.

Organic materials fall into selected groups whose general characteristics are similar. The following groups of materials are listed in the order of their resistance to irradiations:

Group 1: Contains mineralfilled phenolics and mineral-filled furan plastics (Duralon, Haveg 41, asbestos-fiber Bakelite, asbestosfabric Bakelite, and Karbate). Very little damage, except for darkening, occurs up to 10°r.¹

Group 2: Styrene polymers (Styrene 411C, Amphenol) have the best radiation resistance of the unfilled plastics. No change is detected after 10°r, except severe darkening.

Group 3: Modified styrene polymers (Stygon 475) have been classed separately because the impact strength does decrease. At 10°r, however, it is still as strong as in the unmodified material.

Group 4: Aniline formaldehyde (Cibanite) and polyvinyl carbazole (Polectron) show a little decrease in tensile strength at 10°r.

Group 5: Polyethylene and nylon are perhaps the best of the soft materials. Both show definite signs of breakdown at 10°r. Impact strength has decreased but tensile strength has increased. At 4 × 10°r polyethylene is only slightly darker, and no other physical change is detected.

Group 6: Mineral-filled polyester (Plaskon-Alkyol) has lost about 50% of its tensile and impact strength at 10°r.

Group 7: Unfilled polyesters (Selectron 5038, resin CR-39) show a marked decrease in strength at 5 × 10°r, and begin to develop cracks.

Group 8: Phenolics with organic filler (paper-base Bakelite, linen fabric Bakelite, Micarta) begin to fail at 3 × 10 r. They swell and become brittle.

Group 9: Melamine and urea resins (Melmac, Beetle, Plaskon urea, Plaskon melamine) lose about 50% of their strength at 2 × 10°r.

Group 10: Unfilled phenolics



MILE ROCK LIGHT guards the south side of the channel leading through the Golden Gate into San Francisco Bay, one of the world's finest land-locked harbors. The lighthouse, built on top of Mile Rock, is constructed of steel and concrete upon a massive monolithic concrete base 34 feet high. The top of the beacon is 90 feet above mean low water. On the opposite side of the Golden Gate is Point Bonita Light.

Something to steer by for users of electrochemicals are the standards of quality and service set by Niagara Alkali Company. Many leading manufacturers depend, with the confidence of long experience, upon Nialk® Liquid Chlorine, Nialk Caustic Potash, Nialk Carbonate of Potash, Nialk Paradichlorobenzene, Nialk Caustic Soda, Nialk TRICHLORethylene, Niagathal® (Tetrachloro Phthalic Anhydride)

NIAGARA ALKALI COMPANY

60 East 42nd Street, New York 17, N.Y.

(Catalin, Textolite) have lost about 50% of their strength by 10°r. Textolite is slightly darker and more brittle at $4 \times 10^{\circ}$ r.

Group 11: Vinylidene chloride (Saran) and vinyl chloride acetate (Vinylite V) very quickly show signs of deterioration, but they are still serviceable at 0.5 x 10 r. A series of modified halide polymers containing vinyl linkages, which are a group of thermoplastic synthetic materials (Tygon, Ace-Flex), are found here. At 2.68 × 10 r, however, this material turns amberbrown but is still serviceable. At 4 × 10°r, unplasticized polyvinyl chloride softens and becomes rubbery. A marked decrease in tensile strength occurs. These materials become very soft, blacken, and evolve HC1.

Group 12: This group includes all materials that are not considered serviceable beyond 10°r. They are: casein (Ameroid), methyl methacrylate (Lucite), the halogenated polyethylenes (Teflon and fluorothene), and all the cellulosics (cellulose nitrate, cellulose acetate, cellulose acetate butyrate, cellulose propionate, and ethyl cellulose).

These materials become brittle and filled with small cracks. Teflon and fluorothene become soft and tend to crumble more readily. A general loss of strength occurs at 1.95 × 10 r. Lucite turns slightly vellow and becomes somewhat more brittle at $4 \times 10^{\circ}$ r.

Rubber-In general, when rubber compounds are subjected to irradiation they become harder and lose their elasticity and tensile strength. However, an initial difference is noted in Hycar OR and Silastic. The tensile strength is initially increased in these compounds, but after long exposure the strength is

Natural rubber (latex), Neoprene N, GR-S, Koroseal 117, Hycar PH. Hycar OR, and Silastic 7-170 all harden at 10° to 10°r. The threshold for latex was found to be approximately 10 r. Conversely, butyl rubber and Thiokol soften with irradiation. Both butyl and Thiokol eventually become fluid. However, about 20 times as much exposure is required to produce softening

NEXT MONTH . . .

For a long time, usefulness of the highly-important vinyl coatings for chemical plant maintenance has been limited due to low-build per coat. Two new developments have changed this picture, so that required thicknesses can be achieved with a minimum of labor cost. For what's behind these developments and their significance, see next month's Corrosion Forum article by Kenneth Tator.

in Thiokol as is required for softening butyl rubber to the same extent. A marked loss of weight occurs only for Thiokol and Hycar

Materials that are hardened regain their tensile strength after long exposure, but only after severe embrittlement has reduced the elongation to less than 1% of the initial value. Vulcollan, which is a relatively new elastomer, has radiation stability similar to that of Hycar

Irradiation increases the specific gravity of elastomers that are hardened and decreases the specific gravity of the elastomers that are softened.

Plastic and Rubber Paints-Plastic and rubber paints were tested at Oak Ridge National Laboratory and ARCO on steel, aluminum, and concrete surfaces, with results as follows:

Vinvl base paints were tested on aluminum and on steel panels. Samples of Corrosite, Nukemite, and Amercoat 23, 33, and 55 were placed on aluminum panels and were irradiated with a 3.5 × 10°r gamma Co source. All samples showed surface blisters and thus showed failure of the film. Large quantities of halide were present. Blistering of the panels is explained by the hydrogen halide attacking the aluminum.

When Amercoat 23 and 55 were used on steel panels and exposed to 5 × 10°r gamma they showed similar failure. Therefore, these paints are not useful for exposure dosage greater than 10°r gamma.

Samples of Corrosite, Nukemite, G.E. Cocoon, Amercoat 23, 33, and 55, Zerok 110, Alkaloy 550, Amphesive 801, Prufcoat, Duralon 36, and Ampreg on ARCO concrete were irradiated to 10°r (Coo gamma). These samples show no evidence of failure at a dose of 10°r.

The Amercoats, G.E. Cocoon, Corrosite, and Nukemite were examined microscopically at 7.4 × 10°r, and it appeared that all samples, with the possible exception of Amercoat 23, began to deteriorate. Evidence of deterioration was based on formation of small white, blue, black, or green spots on the paint surface.

The following materials also failed at 10°r: Black Amerplate, white polyethylene Amerplate, flame sprayed polyethylene. Kel-F failed at 10'r. The following strip coats (sheet) failed at 10°r: Black Brevon, Blue Tygofilm, Black A89A, G.E. Cocoon, Amercoat strip.

Chemical Damage

Perhaps the most important aspect to be considered when selecting materials to be used in a radiochemical operation is the possibility of damage to these materials caused by chemical reagents. See the chemical resistance chart for guidance.

Optimum Temperature Ranges

Although a given material may be desirable with regard to resistance to damage caused by irradiation and damage caused by chemical agents, if it is not in the optimum temperature range of a particular operation that one factor may disqualify the material.

REFERENCES

- REFERENCES

 1. C. D. Bopp and O. Sisman, Radiation Stability and Elastomers, Oak Ridge National Laboratory, Report No. ORNL-1373, July 1953.

 2. C. D. Watson, Protective Coatings and Decontamination, Oak Ridge National Laboratory Report No. ORNL 52-10-230, Oct. 1952.

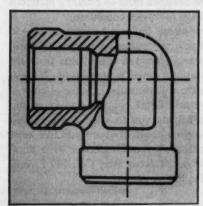
 3. C. D. Bopp and O. Sisman, Physical Properties of Irradiated Plastics, Oak Ridge National Laboratory Report No. ORNL 928, June 1951.

 4. John W. Ryan, Gamma Radiation on Certain Rubbers and Plastics, Nucleonics 11, No. 8 (1953).

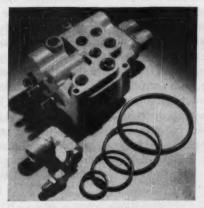
 5. A. Charlesby, How Radiation Affects Long-Chain Polymers, Nucleonics 12, No. 6 (1954).

 6. For decontamination reference consuit ORNL 52-10-230 or Albert E. Salo at University of California Radiation Laboratory.

Simply insert tube; then weld! No wonder Parker's new Weld-lok tube fittings are so easy to use . . . for applications involving extreme temperatures, corrosion conditions, or wherever permanently welded joints are needed. With Weld-lok fittings, you get permanently tight lines . . . unaffected by vibration, shock, or thermal distortion. They're offered for tubing sizes ½ through 2 inches O.D.—steel or stainless steel.



Tapered socket of Weld-lok fittings aligns and holds tube, while you weld. You don't need special fixtures or equipment to make correctly proportioned weld.



What other Parker products interest you? Triple-lok flare tube fittings or In-tru flareless tube fittings for instrumentation? Hydraulic control valves? O-rings?

system components

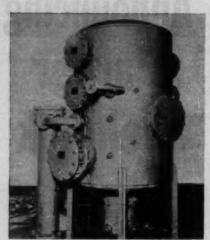
Announcing Parker Weld-lok tube fittings

machined from high-quality steel or stainless steel bar stock and forgings . . . for tubing ¼ through 2 inches O. D.

TUBE AND HOSE FITTINGS DIVISION Section 410-O The Parker Applians 17325 Euclid Aven Cleveland 12, Ohio Send New Parker W	A Marie Marie Andrews
No. 4370	ela-lox cultiog
Name	Title
Company	
Address	

Mail this coupon for your copy of Weld-lok Catalog No. 4370. We will also send you the name of your nearest Parker distributor for Weld-lok tube fittings.

Parker Hydraulic and fluid



This solvent recovery unit—reboiler, condensing and cooling elements—was fabricated of nickel-clad steel.

1 ECONOMY-

fligh alloy layer—usually 10% or 20% of total plate thickness— assures corresion and abrasion resistance, long equipment life.

2 DESIGN FREEDOM-

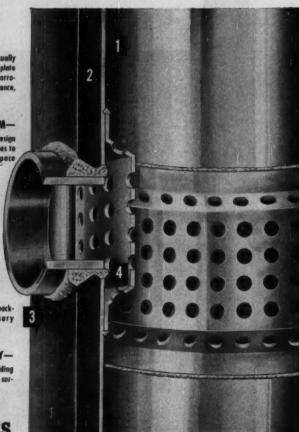
Integral bond allows design and fabrication of shapes to meet process and space needs.



Low-cost carbon steel backing provides necessary strength and rigidity.

4 EASY TO MODIFY-

Normal cutting and welding will not endanger clad surlace or band.



CLAD STEEL EQUIPMENT ASSURES

LONG LIFE AND EASY MODIFICATION

To help you overcome the rapid obsolescence caused by process changes when first costs are high, clad steel equipment offers two unique advantages. First, clad steel construction permits easy tank and vessel revision where new openings must be cut and flanges, pipes or attachments welded on. This means you can design for extra-long service life. The bond between cladding and backing will not tear away and allow harmful seepage.

Second, you get long-life protection from corrosion, abrasion and product contamination—all the advantages of solid, high-alloy construction—with savings up to 50% in material costs. The ASME Code permits full gage consideration for design purposes because cladding and backing are bonded over their entire surface.

Long life and low-cost protection, plus other advantages like fast heat transfer, easy cleaning and minimum maintenance, can be obtained from 16 cladding materials that meet a wide range of service conditions.

And qualified equipment builders know best how to apply these to your new processing equipment. By working with your own engineers and consultants from the start, they can help you get longer equipment life at lower cost. Lukens offers the widest available range of clads—stainless, nickel, Inconel, Monel, copper—and cooperates with fabricators in helping you to select the type best suited to your processing needs. If you would like more information, consult one of your builders or write Manager, Marketing Service, Lukens Steel Co., 749 Lukens Building, Coatesville, Pa.



KENS CLAD STEELS

STAINLESS-CLAD . NICKEL-CLAD . INCONEL-CLAD . MONEL-CLAD

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEEL PLATES AND HEADS AVAILABLE





queeze it out of your resin production picture with U.F. Concentrate-85

THREE OTHER HIGH PURITY FORMALDEHYDE SOLUTIONS ... for a variety of applications

37%..Formaldehyde...37% & 45% 7% Methanol1.5% 3.5.....pH3.5

As with all Nitrogen Division Products, these exceed the specifications of most industrial users.

U.F. Concentrate-85 is the highest concentration of liquid formaldehyde commercially available...59% formaldehyde and 26% urea in a water solution!

... Here are 4 big reasons why you should use U.F. Concentrate-85 for the synthetic resins used in making molding powders, textile finishes, surface coatings, adhesives and special papers:

- Increase production in shorter time with existing equipment.
- · Reduce processing time for dehydration.

- · Charge larger batches to kettles.
- · Save storage, handling and shipping costs.

This is another of the efficient process chemicals provided by the more than 60 years of research, experience and know-how that stand behind all Nitrogen Division products.

For full information and free folder on U.F. Concentrate-85, or other formaldehyde solutions, write today!

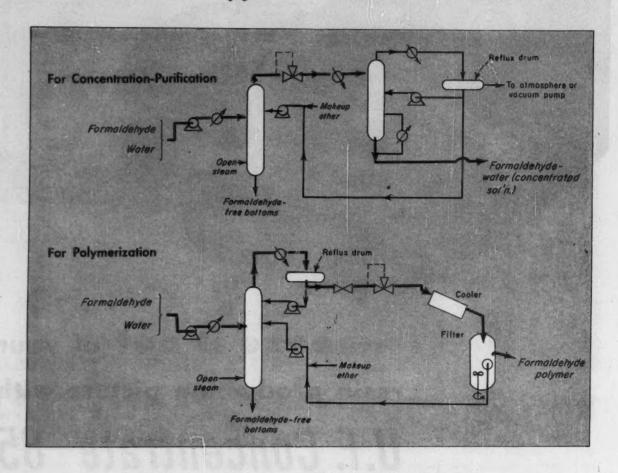


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Hopewell, Va. . Ironton, Ohio . Orange, Tex. . Omaha, Neb.

Anhydrous Ammonia • Ammonia Liquor Ammonium Suifate • Sodium Nitrate Urea • Ethylene Oxide • Ethanolamines Ethylene Glycol • Diethylene Glycol Methanol • Formaldehyde Nitrogen Tetroxide U. F. Concentrate –85 Nitrogen Solutions Fertilizers & Feed Supplements

Tomorrow's Technology Melvin Nord, Chemical Engineer & Patent Attorney, Detroit, Mich.



Formaldehyde: Concentrated and Pure

New distillation technique not only helps formaldehyde shed its water content, but also transforms pure product into solid formaldehyde polymers.

Distillation of formaldehyde-water mixtures with water-soluble ethers is one of the latest entries in the field of formaldehyde purification. The inventor claims that this technique yields a purer, more concentrated formaldehyde than any one of the commercial distillation processes:

 Atmospheric – never yields more than a partially concentrated, purified product.

Vacuum—can't remove traces

of acetic and formic acid, dissolved inorganics.

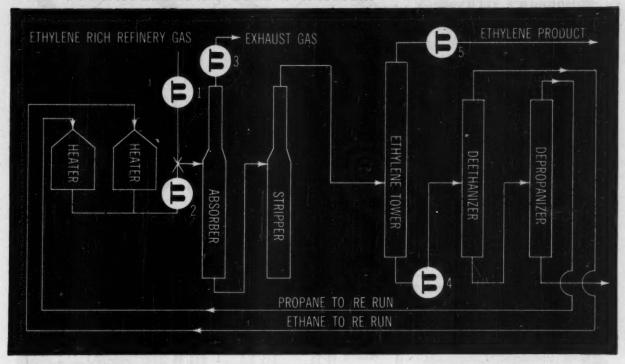
• Azeotropic – can't separate non-volatile impurities.

• Pressure—can't supply liquid formaldehyde reflux (at high temperatures) without destroying the product. Thus fractionation is inadequate.

And what's more, the new method can be used in the preparation of solid formaldehyde polymers Here's how it works. A vaporized stream of formaldehyde and water-soluble ether (e.g., dioxane, p., m-dioxane) are refluxed in a fractionating column. Part of the water condenses, part of the ether vaporizes.

Stripping Section—To promote rapid decomposition of formaldehyde polymers and hydrates, the stripping section of the column (below the feed plate) is maintained at temperatures above 100 C. Monomeric formaldehyde escapes from the water on the trays and flows up into the zone above the feed plate.

Water flowing down through the stripping section becomes poorer in



Ethylene purity guaranteed through use of Tri-non* Analyzers

Even though many elements of process stream environment – temperature, pressure, flow-rate—are under control, a chemical process may not be operating at peak efficiency and product quality suffers.

Why?

Because, environmental control gives no indication of basic stream changes like feed stock composition, loss in stripper efficiency, catalyst poisoning, etc., all of which may effect end product quality.

In chemical processing, it is essential that true control begin with analysis—either batchwise in the control laboratory, or continuously

on the process stream itself.

In the ethylene purification shown above, purity and maximum recovery is guaranteed by infrared analytical control at five points: 1—Ethylene analysis on feed stock for accounting purposes and process control; 2—Ethylene analysis beyond crackers; 3—Ethylene analysis of absorber off-gas for absorber efficiency; 4—Ethylene analysis in ethylene tower bottoms for fractionation tower efficiency; 5—End-point analysis for ethylene purity.

Let Perkin-Elmer engineers show you how your process can benefit through ANALYTICAL CONTROL—made possible with infrared plant stream analyzers.

*TM-The Perkin-Elmer Corp



Both the TRI-NON and BICHROMATOR Analyzer continuously record the concentration of any desired stream component. Each is sensitized and adjusted to specific plant conditions before shipping.

	THE PERKIN-ELMER CORPORATION 830 Main Avenue, Norwalk, Conn.
	Gentlemen:
	Send information on the application of infrared analytical control to the following process problem:
	Send literature on your infrared plant stream analyzers Have a sales engineer call
1	NameTitle
	Company
	Address

PERKIN TELMER - FIRST IN ANALYTICAL CONTROL

formaldehyde concentration. It leaves the column as substantially formaldehyde-free bottoms. (This is not true of other processes.)

Thus it's possible to use open steam to heat the column—without fear of diluting the bottom stream.

Dupper Section—In the fractionator's upper zone, water and etherwater azeotrope are separated at 100 C. And azeotrope plus formaldehyde vapor go off as overhead.

Up to this point, the purifying and polymerizing procedures are identical.

▶ Purifying and Concentrating—If the formaldehyde is to be purified, overhead vapors pass through a pressure valve (regulating pressure and temperature in the fractionator), to a condenser.

Condensed liquid flows to a second column where the pressure is such that a temperature of 40-80 C. is maintained. (Temperatures above 40 C. prevent freezing of liquid and excessive precipitation of formaldehyde polymer.)

Under these conditions, formaldehyde-free azeotrope goes overhead to a condenser, thence to a reflux drum. Part of the liquid in the drum is returned to column #2. The rest is recycled to column #1.

Formaldehyde exits from the bottom of the column-along with water in excess of the amount required to form the ether-water azeotrope.

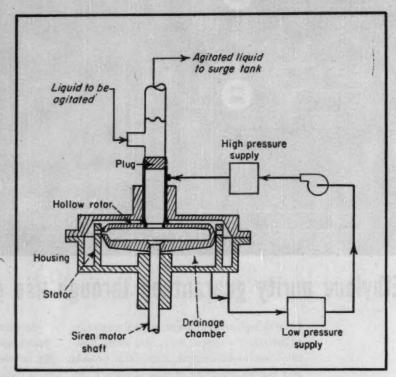
Polymerizing—If the formaldehyde is to be polymerized, overhead from column #1 is condensed, then sent to a reflux drum. Part of the drum's contents is recycled to the column to increase the concentration of formaldehyde in the overhead.

The rest flows—via a pressurereducing valve—to a cooler where the temperature is low enough to induce polymer precipitation. After the polymer forms, it's scraped from the cooler walls and sent to a filter fitted with a stirrer.

Dried polymer—scraped from the filter drum—is either stored or undergoes further processing. Ether and water from the filter are recycled to the fractionator.

In a second patent, the inventor

describes the use of water-soluble alcohols (e.g. ethanol, isopropanol) in purifying, concentrating and polymerizing formaldehyde.—U. S. 2,690,992 and 2,690,994 by James F. McCants.



Agitation via Ultrasonics

Though liquid sirens are usually considered impractical for large-scale applications, here's one which may find some industrial use—i.e. in agitating liquids.

▶ Familiar Principle—The operating principle is the same as that of an air-raid siren. Fluid (in this case, hydraulic oil) flows to a hollow rotor. When the slots in both the rotor and stator are aligned, oil surges through. The overall effect is one of rapid pulsations which generate waves at sonic or ultrasonic frequencies.

These waves are, in turn, transmitted—through a plug having the same acoustic impedance as the generating medium—to the liquid to be agitated. And the liquid passes out of the "reacton zone" (above the plug) into a surge tank.

►No Frictional Drag—Oil discharged from the rotor drops—immediately—into a drainage chamber in the housing. Thus the rotor spins in air and is not subject to frictional drag by the liquid.

In another patent, the author describes the use of a water-hammer type oscillator to generate pressure waves in the circulating liquid.—U. S. 2,693,943 by Arthur A. Fowle to Ultrasonic Corp.

This department is designed to keep you abreast of the latest developments in chemical equipment and processes. Any patents may be ordered from the Commissioner of Patents, Washington 25, D. C. The cost: 25 cents per patent.

the "Phantom Saboteur" of Automation can cause process upsets...recycling. Have a STABILINE Automatic Voltage Regulator designed into your control panel



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can be too expensive a
gamble. We stop it before it
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assurance of trouble - free
processing."



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Superior Electric offers a complete line of automatic
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 Voltage can be a primary variable in pilot plant and commercial processing. When you try to control secondary variables with an unstable primary variable you're headed for trouble. And when it is Varying Voltage Trouble the cause can be hard to diagnose

often, it is at the bottom of the trouble check list. You can never be sure that voltage variations will stay within the safety range of your control panel unless they are under control. Specify a STABILINE Automatic Voltage Regulator in your original specifications—or build one into your present control system.



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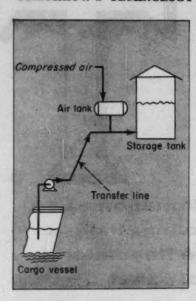
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Nama

Company Name.....

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Novel System Solves Oil Transfer Problem

A common problem in ship-toshore oil transfer is the accurate measurement of the volume of oil delivered from the barge to the storage tank. Variations in the amount of empty (air) space in the transferline—before and after transfer often cause serious errors in volume measurements.

These errors are eliminated by Standard Oil Development Co. in a novel system designed to calculate and correct for line variations.

As shown, a compressed air tank (of known volume) is hooked up to the transfer line. Tank and line pressures are measured twice—before and after air's fed to the line. Ideal Gas Law—The volume of empty (air) space in the line can then be calculated from the ideal gas law:

 $V_{\rm polds} = V_{\rm tank} (-\Delta P)_{\rm tank}/(\Delta P)_{\rm line}$. And the change in empty space—before and after pumping—is the correction factor applied to the volume of oil transferred from the barge.—U. S. 2,696,113 by James H. Prescott and Emmet V. Dunathan to Standard Oil Development Co.

Forced Circulation Boosts Heat Transfer

Forced downward circulation of brine through the vertical tubes of a thermocompression distillation setup is the key to more efficient heat transfer.

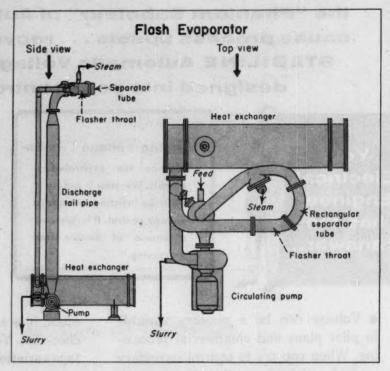
The forced circulation technique:

• Creates a tube pressure which is less or, at most, slightly greater than that in the vapor space. Thus boiling takes place throughout the tube, not just at the end of the tube.

• Causes higher flow veloci-

And it's these features which combine to hike the system's heat transfer rate.

Energy supplied to the circulating pump isn't lost. It's used—along with heat from the compressor—to heat the system.—U. S. 2,696,465 by Arthur E. Kittredge.



Something New in Flash Evaporators

Centrifugal force separates vapor from salt-carrying liquids in this improved single effect, flash evaporator.

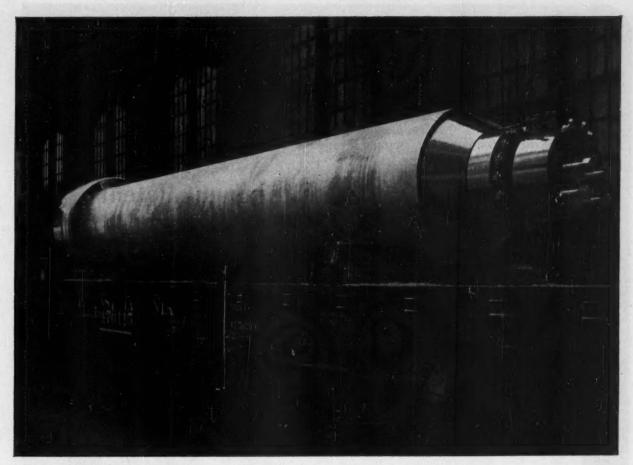
Brine enters the system—through a feed nipple—and collects in the discharge tail pipe until there's a sufficient reservoir for the circulating pump. The pump then delivers the brine to a heat exchanger where it's heated (under pressure) to 230-235 F

▶ Boiling and Expansion—From the exchanger, brine flows to a discharge line leading to the flasher throat. Here it begins to boil. And

the force of rapid expansion increases its velocity as it moves toward the rectangular separator unit.

This high velocity causes greater centrifugal and centripetal forces to act on the liquid and vapor. As the boiling, expanding liquid flows around the U-shaped tube, centrifugal force throws the heavier salt-carrying liquid to the outer wall of the unit.

- ► Tube Design—Two features of the tube design—position and cross section—contribute to effective separation:
 - · Position-because the tube is



ExtraSTRENGTH... Added SAFETY... Sealed for SERVICE MIDVALE FORGED PRESSURE VESSELS

Product-Converter Body Diameter-55"

Inside Diameter-

Ring Diameter-

Overall Length-37'-2-15/16"

Operating Pressure-5,625 P.S.I.

Yield Strength-50,000 P.S.I.

Shipping Weight-144,240 ibs. From the time this converter was on the drawing boards at Midvale until it was ready to roll on this flatcar strength and service was the keynote. Veteran steel makers melted the right alloy steel. Skilled hands forged toughness into it.

This converter is not unusual for Midvale—not the largest, not the smallest we make. A 268,000 pound octagonal ingot was forged and machined to an overall length of more than 37 feet with a body diameter of 55 inches. Hydrostatically tested at 8,450 psi. for working pressures of 5,625 psi. . . . yield strength of 50,000 pounds.

Midvale engineers, working with those of the chemical company, designed this converter to fit the specific needs of the plant. At one end of the vessel with full diameter opening the head is held on by a screwed yoke. Sealing is effected by a triangular-shaped copper gasket, sealing force attained by set screws. The other end of the vessel is closed down to about one-half the main diameter, a cover bolted on and self-sealing steel gasket of the "delta" type used.

Converters, autoclaves, separators, high-pressure accumulators, reactors... Midvale can forge them for your plant to meet specific processing requirements of pressure and capacity. Let our engineers work with you from initial design to final installation.

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FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS



TOMORROW'S TECHNOLOGY . . .

horizontal, there's little or no gravitational effect exerted on the vapor and liquid. Therefore small particles of steam and liquor do not mix with each other.

• Cross section – the tube's rectangular cross section makes for

substantially equal steam and liquor velocities.

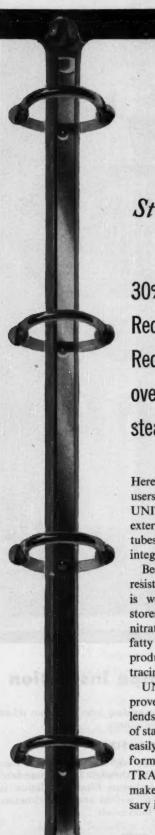
As separated steam and liquor continue around the centrifugal unit, steam is drawn off to the atmosphere or under vacuum. Saltcarrying liquor leaves the tube at about 227 F., then flows down into the tail pipe section. Periodically, concentrated slurry is drawn out of the evaporator system via the slurry discharge nipple.—U. S. 2,696,248 by Horace W. Diamond to Morton Salt Co.

Your Checklist of New Equipment Patents

Operation	About	Inventor or Assignee	Patent No
Adsorption	Continuous adsorber	Phillips Petroleum Co	2.696,304-5
	Regulating the flow of solid adsorbents	Socony-Vacuum Oil Co., Inc	2,696,462
	Continuous adsorber-desorber	Phillips Petroleum Co	2,696,510
Extrusion and molding	Extruder for elastomer epds	Western Electric Co., Inc.	2,695,422
	Plastics molder	The Polymer Corp. (Pa.)	2,696,023
	Extruding and drying plastics	National Lead Co	2,696,639
	Extruder	Dynamit Actien-Gesellschaft vormals Alfred Nobel & Co.	
	Injection cylinder for molding machines	Lester Engineering Co	2,696,641
Filtration	Filter aid	Phillips Petroleum Co	2,696,306
	Rotary drum filter	Laurence Bultman	2,696,309
	Rotary filter, removable from casing	G. D. Dickey and H. M. Hunter	2,696,916
Fluid and particle flow	Pneumatic transfer of granular contact material in a moving bed	Socony-Vacuum Oil Co., Inc	2,695,815
	Slide valve for controlling fluidized solids flow	Standard Oil Development Co	2,696,362
Screening	Screening mechanism	Gotthold H. Meinzer	2,696,302
Solid-gas separation	Gas cleaner	Research Corp	2,696,273
	Air and gas treating system	Southern Lightweight Aggregate Corp	2,696,274
	Gas humidifying and electrical precipitation system	California Portland Cement Co	2,696,892
Solid-solid separation	Flotator-clarifier	F. S. Gibbe, Inc.	2.695.710
	Hydraulis classification of minerals		2,696,298
	Continuous separation of solids mixtures into two fractions		2,696,299

... And New Process Patents

Product	Process	Inventor or Assignee	Patent No
Carbon	Production of pelleted furnace carbon black	Phillips Petroleum Co	2,695,837
Ceramics	Forming a ceramic body	Clevite Corp.	
Dyes		General Aniline & Film Corp	
	Production of halogenated quinasoline dvestuffs	Badische Anilin-& Soda-Fabrik A. G.	2,697,097
Ganna	Thermophore pellets used in air rectification	Hydrocarbon Research, Inc.	2,696,718
Hydrocarbons	Coke oven byproduct recovery	United Engineers & Constructors Inc	
Inorganic chemicals			
Inorganic chemicals	Purifying HCl solutions	Rohm & Hass Co	2,695,875
	Hydrazine manufacture	M. W. Kellogg Co	
	Manufacture of boron trifluoride	Harshaw Chemical Co	2.697,027
Organic chemicals	Manufacture of perhalogenated polymers under controlled conditions	M. W. Kellogg Co	2,694,701
	Urea preparation	American Cyanamid Co	2,694,728
	Disproportionation of chlorofluoromethanes	E. I. du Pont de Nemours & Co	2,694,739
	Amines separation	Imperial Chemical Industries Ltd	
	Preparation of aromatic carboxylic acids	California Research Corp	2,695,312
	Oxidizing nonaromatic organics	California Research Corp	2,695,313
	Catalytic preparation of polysulfides from	Phillips Petroleum Co	2,695,316
	alkyl sulfides		a discount of the
Pigments	Making aluminum oxide pigment	Godfrey L. Cabot, Inc	2,693,406
	Production of chromium oxide pigments	C. K. Williams & Co	2,695,215
	Preparation of iron oxide pigments	American Cyanamid Co	2,696,426
Resins	Preparing novolak resin derivatives	Monsanto Chemical Co	2,694,051
	Interpolymerization of aromatic vinyl cpds., glyceride oils and oil-alkyds	Farbenfabriken Bayer A. G	2,695,896
	Tall oil esters produced with monohydric phenols	Maxwell A. Pollack	2.695.897
	Cork as a flow modifier in phenol-formaldehyde molding opds.	Weyerhauser Timber Co	2,697,082
	Modified melamine-formaldehyde resin	American Cyanamid Co	2.697.086
Rubber.	Synthetic elastomer hydrogenation process	Phillips Petroleum Co	
	Making linear interpolymers of monovinyl aro-	Dow Chemical Co	2,694,692
	matic cods, and a natural or synthetic rubber		2,002,002
	Foaming and coating rubber	E. T. Oakes Corp	2,695,246
	Cottonia and conting rubber	P. 1. Oakes Corp.	2,695,328
	Softening rubber	Dunlop Rubber Co. Ltd	2,695,898
	Rubbery polymers plasticised with thio- derivatives of polychlorobensenes	Farbenfabriken Bayer A. G	
	Compounding rubber-like butadiene polymers with 1,5-pentanediol di-esters	Sun Oil Co	2,697,087
Bynthesis gas and products	Separating oxo alcohols	Standard Oil Development Co	2,693,493
	Synthesis gas production	Gulf Research & Development Co	2,694,047
	Oxo process—using mixture of alkenes and	Imperial Chemical Industries Ltd	2,694,091
	dienes		
	Synthesis of oxygenated organic epds	Standard Oil Development Co	2,695,315



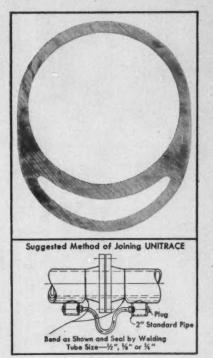
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30% of labor costs
Reduces material costs
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steam-jacketed lines

Here's a totally new product for users of steam-traced piping. ALCOA'S UNITRACE® eliminates the cost of external steam jackets or steam-tracer tubes because the steam line is an integral part of the aluminum pipe!

Because of the natural corrosion resistance of aluminum, UNITRACE is well suited for handling naval stores, molten sulphur, ammonium nitrate solutions, glacial acetic acid, fatty acids, tar, pitch and similar products normally requiring steam tracing.

UNITRACE provides greatly improved heat transfer properties . . . lends itself readily to shop fabrication of standard lengths . . . can be formed easily with pipe bending tools. Preformed insulation will fit UNITRACE, but improved efficiency makes thermal insulation unnecessary in many cases.



UNITRACE is available in 2 inch standard schedule 40 pipe size.

For complete information, write for *free booklet*. Use the coupon.

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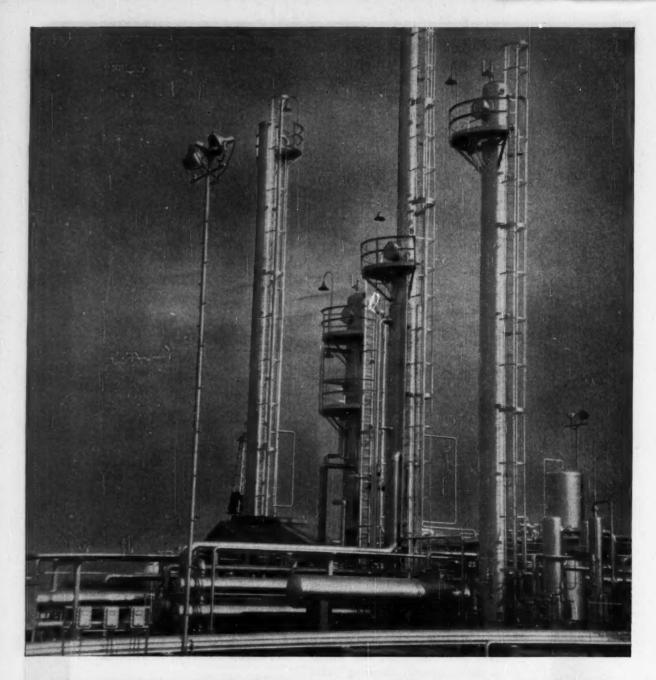
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Unibestos means stronger, longer lasting pipe insulation

Amosite...the South African asbestos with long, strong, resilient fibers gives Unibestos Pipe Insulation greater strength and superior insulating ability. Built for durability, Unibestos resists both vibrations and shock, and is unaffected by most acid and chemical fumes. When lines must be relocated and replaced, Unibestos can be removed and reapplied with little or no loss of material.

Single Layer Construction Cuts Installation Costs

Unibestos is easily handled—can be cut, mitered, for quick installation, requiring little pointing of joints. Unibestos reduces scaffolding needs, and speeds completion of job.

Unibestos Reduces Heat Loss

Tests prove that Unibestos single-layer pipe insulation

provides greater protection against heat loss than other nonfibrous double-layer insulations.

STANDARD PRODUCTION SIZES

Unibestos Pipe Insulation is regularly made in 3-foot lengths for pipe sizes from ½" through 24", in standard thicknesses through 5". Unibestos Block Insulation is made in 6", 12", 18" or 36" widths and in thicknesses from 1" through 3" in ½" increments.

For complete information, write for Descriptive Bulletin 109C.



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"We have been using several

Rodney Hunt Turba-Film evaporators for
the concentration of solutions containing
heat-sensitive pharmaceutical products.

Due to special design, the Turba-Film evaporators

show excellent performance and are superior to conventional evaporators. Evaporation takes place rapidly with only brief contact of the heat-sensitive material with the heating area.

Exposure to heat also is more uniform than in other evaporator designs, due to forced circulation in the form of an even film of liquid. Decomposition through overheating is avoided and the quality of the product, therefore, is excellent.

Entrainment of product solution by the vapors is easily eliminated in the top separating section of the Turba-Film evaporators. Heat transfer efficiency is excellent."

When dry powders are required, Rodney Hunt Spray Dryers complete the process following Turba-Film Evaporators and produce fine powders or minute non-dusting globules.

Manufacturing Engineers Since 1840

RODNEY HUNT MACHINE CO.

31 VALE STREET, ORANGE, MASSACHUSETTS, U. S. A.

RODNEY HUNT

Hoffmann-La Roche, Nutley, N. J., plant uses Turba-Film Evaporator (left, above crystallization chambers) in concentration of dissolved heat-sensitive products

Process Equipment News Edited by Calvin S. Cronan

NEW MAINTENANCE TOOLS & SUPPLIES



Simplify Testing of Valves

With this low-cost, semi-portable unit working in your valve shop or at "on-site" location you will speed testing, cut down-time, save labor and money.

If you're looking for faster, more sure-fire, economical methods you'll do well to take a good look at this new valve-testing station. It's said to boost plant efficiency by combining all testing equipment in one compact unit. Statistical analysis indicates it will test 97% of all globe, gate, plug cocks, safety and relief valves.

Selling for one-third the average cost of a custom built-in-plant test station this unit is said to pay for itself with savings made during one turn around a plant's valve facilities. And it completely eliminates need for valve repair work by outside shops.

Here are some of the built-in features:

- Portability made easy by 4in. H-beam-skid mount.
- Compact 5-ft. by 3-ft. 8-in. dimensions take minimum floor space.
- Ready to operate once water, air and electrical utility lines are connected.

- Engineered ASME construction throughout.
- Floor testing provided for large, heavy valves.
- Accessory equipment such as spools, gages, gaskets, wrenches and lapping equipment are included.
- Compressed gas testing facilities can be included at extra cost.

To start your test program off on the right foot the manufacturer furnishes an instruction manual containing time-tested and proven test data. Correction factors for given service conditions allow you to adjust and set valves properly. On startups this is a big factor in getting on stream right the first time. Over a long term it means reduced operating cost.

► What's What—Unit has circuits for running both pneumatic and hydraulic tests. Air compressed to 500 psi. (standard model) comes from a tank supplied by a compressor. An air-powered booster pump with 60 to 1 ratio furnishes hydraulic pressure up to 6,000 psi. Air testing in the 500-6,000 psi. range is handled by admitting air between the water output of the pump and the valve being tested.

On top of the stand you see four test outlets. On the left is that used for water testing, 10-6,000 psi. and air testing, 500-6,000 psi. The others are for various valve sizes in the 0-500 psi. range.

There is sufficient air volume from the enclosed supply tank for testing all safety valve sizes. Heavy forged C clamps and necessary adapters are provided for mounting valves.

► Everything Within Reach—On the left side of the cabinet are located an electrical safety switch at table level and floor testing facilities for large valves and other equipment. A data board hangs in an accessible position near the table level. An air hose with nozzle is included.

Mounted on the control panel are all necessary test and operating pressure gages, control valves, trans-





it looked like a good deal...

But he found out that first cost isn't all you have to pay

Here's the "check" for one of our customers

During seven years an oil and chemical manufacturer purchased three LaBour Type G chased three LaBour Type Sold him pumps. We've sold him pumps worth of parts, for an average cost of \$46.30 per pump per year.

With chemical pumps as with so many things in life, first cost is an unreliable guide to ultimate cost. In fact, because chemical pumps are often subjected to severe service conditions, even the best of them may require substantial maintenance expense.

When you choose LaBour Type G you know you're going to come out with low total over-all costs, because LaBour Type G has been setting records for minimum service requirements in all sorts of applications. That's why we deliberately invite the most searching comparisons from your own records—and will help you get the facts together if you'll only consult us.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR

Equipment on these pages made news this month . . .

Equipment Cost Indexes, p. 246	Page number is also Reader Service code number
New Maintenance Tools & Supplies	Linear Bearing254B
Valve Testing Station244A	Spacer Coupling254C
Welding Process246A	Mixer Shaft Scal254D
New Instruments & Controls	New Heating & Cooling Equipment
Automatic Data Logger248A	
Specific Gravity Meters248B	Steam Trap 256A Heating Tape 256B
Explosion Detector	Hot Salt Heater
Thermistor	Standard Heaters
Density Gage	Heat Exchanger
Air Regulator	ricar Exchanger
Recording Ink	
	New Fluids Handling Equipment
New Packaging & Handling Equipment	Industrial Fans
Tractor Shovel	Industrial Mixer
Steel-Belt Conveyors	Pipe Connector
Vibratory Packer	Check Valve
Chemical Tanker	Process Pumps
	Compressed Air Filter
New Electrical & Mechanical Equipment	High-Pressure Trap
Dry Fluid Drive	Plug Valve
Rectifiers	Vapor Collecting Head

. For more details, use Reader Service Card

fer valves, start-stop switch, an electrical outlet and a plate with brief operating instructions permanently inscribed on it.

The cabinet is constructed of heavy-gage steel with a corrosion-resistant finish. Two drawers are provided for storage of lapping equipment and small tools. Also there is storage space for heavier fittings and adapters.—Farris Engineering Corp., Palisades Park, N. J. 244A

Welding Process

For butt welding stainless and alloy steel pipe.

Through use of The EB Weld Insert process either seamless or welded stainless and alloy pipe can be butt welded with the actual welding being done on one side only. A smooth, uniform weld surface is obtained using a conventional, inert-gas-shielded, tungstenare torch.

Weld insert is a ring that is tack welded in position between pipe ends to be joined. In cross section the ring looks like the head of a rivet, with a short section of shank attached. The rounded inner periphery of the ring is inside the pipe with the squared outer surface filling the space between the root faces.—Arcos Corp., 1500 South 50th St., Philadelphia 43, Pa. 246A

For More Information . . .



about any item in this department, circle its code number on the Reader Service

Postcard inside the back cover.

Equipment Cost Indexes

Sept.	Dec.
1954	1954
Industry	
Avg. of all184.5	184.2
Process Industries	
Cement mfg 177.3	177.1
Chemical185.9	185.7
Clay products172.1	171.9
Glass mfg 175.7	175.5
Paint mfg179.0	178.8
Paper mfg 179.3	179.1
Petroleum ind182.5	182.3
Rubber ind 1849	1847

Related Industries

Process ind. avg..183.0

Elec. power equip 187.7	187.5
Mining, milling 186.8	186.6
Refrigerating204.5	204.1
Steam power 175.2	175.0

182.8

Compiled quarterly by Marshall and Stevens, Inc. of III., Chicago, for 47 different industries. See Chom. Eng., Nov. 1947, pp. 124-6 for method of obtaining index numbers; March 1955, pp. 178-9 for annual averages since 1913.





MIDWEST "LONG TANGENT" ELBOWS COST NO MORE THAN OTHER ELBOWS

THESE MIDWEST "LONG TANGENT" ELBOWS SAVED \$4121 IN PIPE

Here are 1227 Midwest "Long Tangent" Elbows (12'', 14'' and 16'' standard weight) ready for shipment to a chemical plant. Each Midwest "Long Tangent" Elbow has a straight section on each end equal in length to $\frac{1}{4}$ the nominal pipe size. Thus a 12'' elbow saves 6'' of 12'' pipe while a 16'' elbow saves 8'' of 16'' pipe. It doesn't take long to save a lot of pipe and a lot of money . . . in this instance \$4121.

But saving pipe is not the only advantage of Midwest "Long Tangent" Elbows. They often eliminate short nipples and their extra welds... save time and money in lining up and clamping pipe and fittings... slip-on flanges are more easily applied. For all the facts, write for Catalog 54.

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo. Plants: St. Louis, Passaic, Los Angeles and Boston

Sales Offices

New York 7—50 Church St. • Chicago 3—79 West Monroe St. Boston 27—426 First St. • Los Angeles 33—520 Anderson St. Houston 2—1213 Capitol Ave. • Tulsa 3—224 Wright Bldg. Cleveland 14—616 St. Clair Ave. STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

MIDWEST WELDING FITTINGS

MIDWEST WELDING FITTINGS Improve Piping Design and Reduce Costs

Automatic Data Logger

Converts instrument signals into tabulated digital records.

Tabbed as a link between past and future control methods the automatic data logger can be integrated with industrial instrumentation systems now being used. It permits automatic control, computing, cost accounting, statistical analysis or process reset with a punch card programmer.

Process data are recorded automatically in vertical columns on the log sheet. Simultaneously, identification digits for each variable are punched on a tape in convenient form for computations.

Even though data are recorded sequentially over a period of time the variables can be measured at the same instant of time and held by mechanical or electrical memory units until readout. Between periodic readout cycles the logger scans and monitors all variables continuously. Abnormal conditions are recorded as they occur.

Data are reduced to the most suitable form by analog computer techniques prior to digital presentation.—Fischer & Porter Co., Hatboro, Pa. 248A

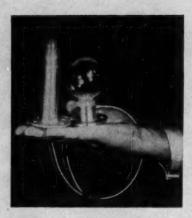
Specific Gravity Meters

Measure and automatically control solutions and slurries.

A new line of bubbler-type specific gravity meters can be calibrated directly in terms of specific gravity, Twaddell units, degrees Baume or other appropriate units. Used with any liquid where a bubbler pipe can be inserted they are factory calibrated for the liquid being measured.

Meter operates by comparing the pressure needed to displace a given head of sample liquid in the bubbler pipe with the pressure needed to displace an equivalent head of water. Meter and recorder also can be equipped with automatic control in any of five control modes.—

The Bristol Co., Waterbury 20, Conn. 248B



Explosion Detector

Guards storage vessels containing flammable liquids.

Striking back with the speed of light a newly available device snuffs out incipient explosions within a fraction of a millionth of a second. Detection and counteraction are tied to infrared radiation generated by the high-speed combustion.

Radiation from a starting highrate flame is detected by a minature photoconductive cell. With extraordinary rapidity the electrical resistance of the cell changes to set off a detonator in a small plastic container of fire extinguisher fluid. Container shatters spreading fluid at a 300-ft.-per-sec. rate.

Detector can only be used within confined spaces where there is no ambient infrared radiation. To attain such high speed response it has been necessary to strip the device of all discriminatory functions.

A complete self-contained system consists of one detector and one or more plastic containers.

Industrial applications already under way include fuel storage tanks, pumping stations and similar areas.—Electronics Corp. of America, 77 Broadway, Cambridge 42, Mass. 248C

Thermistor

Is tiny and very stable at high operating temperatures.

A new type thermistor combines high-speed response with extreme stability at high operating temperatures. It is rated for a maximum continuous temperature of 300 C., has good stability to 400 C.

The tiny glass-coated ceramic element of the type L 118 thermistor has a diameter less than 0.018 in. with 1 mil dia. platinum alloy leads. Thermal time constant of the unit is only one second in still air, and even less in liquids.—Thermistor Corp. of America, Metuchen, N. J. 248D

Density Gage

Based on radioactive absorption is mounted externally.

Percent by weight of solids or liquids in slurries now can be measured readily and controlled using the new model PS series density gage. Relying on radioactive absorption and Ohmart cells for measuring, these gages can be mounted external to the system where they cannot be harmed by slurry conditions.

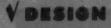
PS gages have high sensitivity and precision. Measuring a 10-in. span of water slurry containing solids with specific gravity of 2.0 precision is 0.3% in the 0-40% solids range. From 40 to 80% solids precision is 0.2%; above 80% solids precision is 0.1%.

Gages are being used on water slurries of asbestos cement, magnetite, clay, grinding compounds, coal and similar materials.—The Ohmmatt Corp., P. O. Box 67, Sta. B, Cincinnati 22, Ohio. 248E

Adjustable air regulator provides a reliable, drift-free source of clean, dry air for instrument service or air-regulated equipment. Flow capacity up to 15 cfm., max. inlet pressure 150 psi., automatic relief and efficient water separation.—Kendall Controls Corp., 144 Moody St., Waltham, Mass. 248F

Recording ink furnished in oneounce squeeze bottle with capillary tube and filter assembly is smooth flowing, dries quickly without feathering. Performs well over wide temperature range and varying industrial conditions. —The Foxboro Co., Foxboro, Mass. 248G

HELILLIY







The advantage of working with one versatile source of equipment has been recognized by leaders & in the process industries. A high degree of flexibility can more effectively correlate new equipment with existing facilities.

The equipment illustrated here demonstrates Acme versatility, proved through past performance in all processes.

From pilot plant to full scale operation ... from drawing board to actual installation, Acme is pre-eminently equipped to serve the diverse needs of the process industries.





Tractor Shovel

Outdoes performance of predecessors.

Not content with nominal improvement the new HA model Payloader digs, lifts and carries twice as much as its predecessor. With payload capacity of 18 cu. ft. and struck load capacity of 14 cu. ft. productive capacity is increased from 50 to 100%.

In spite of these increases the new Payloader is more maneuverable because it has a shorter turning radius. It can operate into and out of boxcars with ease.

New bucket arm design gives exceptionally fast breakout of the load and 40-deg. rotation of the bucket. Heaped bucket can be carried at a lower level, providing greater stability and operator vision.

Fast operating cycles and operating ease are assured by combined torque converter drive and full-reversing transmission.—The Frank G. Hough Co., 754 Seventh St. Libertyville, Ill. 250A

Steel-Belt Conveyors

Can be assembled from preengineered components.

Users of steel belt conveyors now can engineer a complete conveyor merely by selecting pre-engineered components to meet requirements. The pre-engineered units eliminate such detailed design work as specifying bearings, shafts, pulley sizes, etc.

Trial-and-error selection of items such as belt and pulley scrapers,

unloading devices, and safety equipment is avoided. Correct operation of the final assembly is assured.

Typical packaged components include drive-end and tension-end assemblies, steel belts, discharge devices, safety devices and loading hoppers.—Sandvik Steel Belt Conveyors, Div. of Sandvik Steel, Inc., 111 Eighth Ave., New York 11, N. Y. 250B

Vibratory Packer

Handles containers up to 2,000 lb. capacity.

Model VP-600 vibratory packer has a deck 48 by 48 in. with a weight capacity of 2,000 lb. It is used to increase net weight content of shipping containers such as barrels and drums.

Packer is powered by a "semi-

For More Information ...

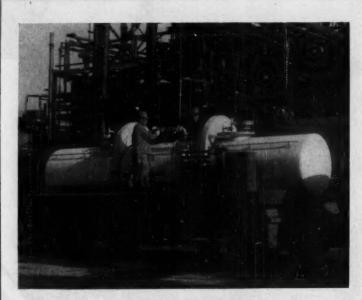


about any item in this department, circle its code number on the Reader Service

Postcard inside the back cover.

noiseless" pulsating magnet. The striking parts of the magnet contact a rubber bumper and keep the operating noise down to a minimum. Variable control permits the operator to adjust the amplitude of vibration to the desired degree.

Packing action is instantaneous. Most materials respond sufficiently to provide up to 20-30% additional space. Packer operates on 220-v., 60 cycle a.c. power, weighs 1,700 lb. complete.—Syntron Co., Homer City, Pa. 250C



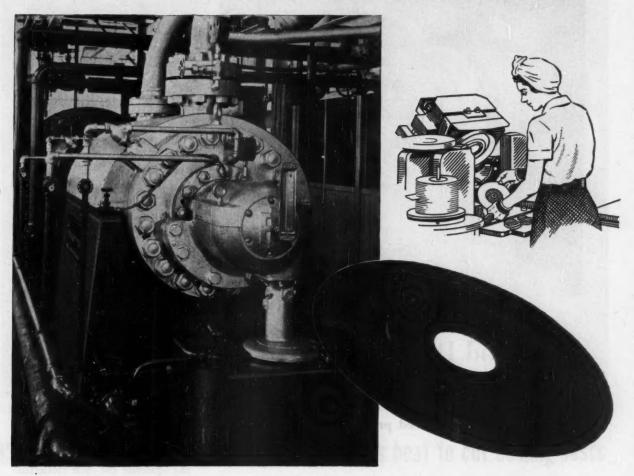
Safe Passage for Chemical in Nickel Tanker

New caller at Monsanto Chemical's W. G. Krummrich plant, Monsanto, Ill. is this nickel tank truck. Taking on a load of benzyl chloride it will deliver the sensitive lading intact to the customer without contamination. Two-compartment tank holds

2,185 gal., is unloaded by a nitrogen-blowing system. Benzyl chloride is an intermediate for dyestuffs, perfume bases, plasticizers, resins, wetting agents, germicides, rubber accelerators and various pharmaceuticals.

I-R PUMP MAKES NEW RECORDS

for RCAVICTOR



PUMPING music into a phonograph record is a somewhat unusual assignment for an I-R pump. Yet that's exactly what this high-pressure CHTA unit is required to do. For it supplies power to RCA Victor's huge hydraulic record presses, where metal stampers mould the recorded grooves of music into the Vinylite surface of the disc at a pressure of about 1800 psi. That's almost 150 tons for a 7" record!

The Ingersoll-Rand CHTA pump shown above is provided with a fluid drive coupling which permits discharge pressure to be maintained within 25 pounds of the 1800 pound design pressure, regardless of flow. This uniform pressure helps RCA Victor records achieve consistently faithful reproduction of the original live sound.

I-R maintenance-free DMV single-stage pumps return the spent water from a reservoir to the high pressure pump suction at 40 psi. Careful instrumentation by RCA engineers guards the entire system and provides warning of any unusual operating conditions.

Other I-R equipment at this same RCA plant includes service water pumps, and non-lubricated compressors that supply oil-free air used in TV tube production.

Ingersoll-Rand pumps are known throughout industry for their quality workmanship and dependable performance. Consult one of our branch offices on your pumping problem—there's an economical solution in the complete I-R pump line, no matter what the requirements.



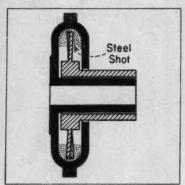
10-102

PUMPS . COMPRESSORS . TURBO-BLOWERS . ROCK DRILLS . AIR & ELECTRIC TOOLS . VACUUM EQUIPMENT . DIESEL ENGINES

CHEMICAL ENGINEERING—April 1955







Dry Fluid Drive Runs Without Slippage

. . . Yet at startup it slips to give smooth acceleration. And it slips when you need protection from shock and overloads.

Industrial power is going to be transmitted by a new-type fluid drive—one that is entirely dry. Using fine particles of spherical steel shot as the fluid-flow charge, the Flexidyne drive handles heavy inertia and shock loads with ease. It is expected to be applied widely on compressors, centrifuges, conveyors, crushers and agitators.

While possessing slip characteristics common to other fluid drives on startup and overload, the Flexidyne uniquely runs without slippage at normal operating speed and load. And the torque capacity can be varied by changing the amount of flow charge in the housing.

Flexidyne is compact (8-in. dia. housing for 10 hp., 1,750 rpm.

unit), low cost, efficient, and requires little maintenance. It permits use of smaller, cheaper motors and controls, with greatly reduced current demands and improved power factor.

Drive in Cross Section—The Flexidyne drive, pictured above, consists of concentrically-mounted housing and rotor. Between these two elements is the flow charge of fine, spherical, steel shot with flow properties very much like those of a fluid. This charge is easy to seal in, has high density and can stand relatively high temperatures.

► Transmitting the Power-Power from the drive motor turns the housing. As the housing revolves the flow charge is thrown to the

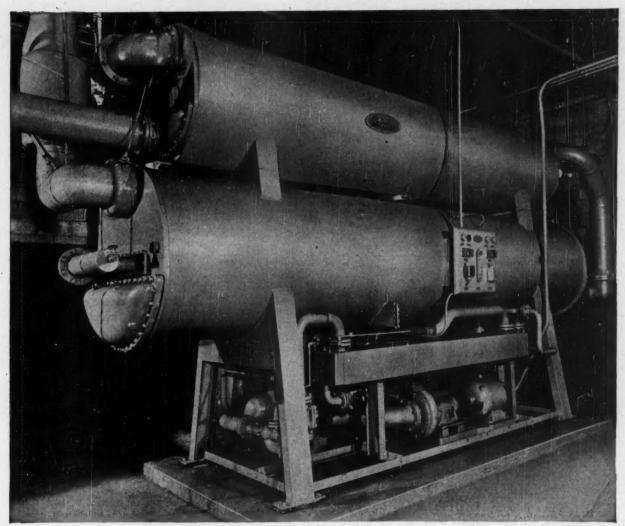
circumference and compacted by centrifugal force so that it revolves with the housing.

Friction and the wedging action of the revolving flow charge start and accelerate the rotor connected to the load. The wave-like configuration of the rotor provides surfaces for the steel shot to wedge against. Rotor and housing reach identical speeds and run with zero slippage under normal conditions.

In case of overload, before damage is caused, the Flexidyne rotor slips relative to the housing, overcoming the friction and wedging action of the flow charge. A thermal switch can be provided to cut off the electrical circuit if an overload persists.

Departing Flexibility—Because users can vary the flow charge Flexidyne can give the exact starting torque needed for anything from the smoothest to the fastest start.

Flexidyne can be set to slip at



This 350-ton Carrier Absorption Machine is installed at the Joseph Horne Co. Suburban Store in Brentwood Borough, Pennsylvania.

Carrier Absorption Refrigerating Machine uses heat to cut cooling costs

-and AnacondA Cupro Nickel Tubes are again called on for economical quality performance in industry

Until recently, plant and building engineers have been hung on the horns of a cooling dilemma; how to use low pressure steam—frequently exhausted



Rolling-in ANACONDA Cupro Nickel Tubes in absorber for new Carrier Absorption Machine.

as waste—for chilling water for air conditioning and process cooling. No economical way seemed to exist to harness this heat as a work horse for cooling.

Carrier Corporation, leading manufacturer of air conditioning and refrigerating equipment, found the solution in absorption refrigeration. In 1942, they installed the first pilot plant at the Carrier laboratory using water as a refrigerant and lithium bromide as the absorbent. Since then, a growing number of these large capacity units have been put into operation. They have few moving parts, are practically vibration-free, weigh less per rated ton, and adjust automatically to load.

Carrier selected ANACONDA Cupro Nickel Tubes for use in these machines because of their excellent service record for trouble-free performance under all operating conditions.

What are your condenser and heat exchanger problems? In selecting the proper tube alloy, the experience of our Technical Department is freely available to you. Use it as a short cut to the right solution. Write to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

FOR EFFICIENT HEAT TRANSFER

ANACONDA®
HEAT EXCHANGER TUBES

anywhere from 20% in excess of full load torque to as high as peak motor torque. During starting and overload periods minimum current is drawn because motor is never pulled below 90% of synchronous speed with the standard Flexidyne setting.

First Available-First Flexidyne drives offered from stock this spring will be four sizes rated 3 to 30 hp. at 1,800 rpm. They can be furnished either as drives for shaft mounting and adapted for Taper-Lock sheaves, or as couplings with Taper-Lock bushings for straightline drives .- Dodge Mfg. Corp., Mishawka, Ind.

Rectifiers

Convert high amperage a.c. to

Tiny wafer-thin germanium rectifiers are being used to convert a.c. to d.c. at high amperage and comparatively low voltage. They are small (about the size of a dime), highly efficient, stable; have high inverse voltage rating and very small reverse current.

One germanium rectifier installation now in operation, on reclamation of tin from tinplate scrap, is supplying direct current at 800 amp. and 125 v. Others on order for chemical, aluminum, steel and titanium plants are rated 16,000 amp. at 65 v., 12,000 amp. at 130 v. and 40,000 amp. at 24 v.-General Electric Co., Schenectady, New York.

Linear Bearing

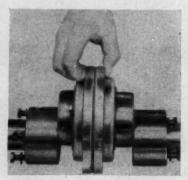
With anti-friction features can operate under corrosive conditions.

Only recently available, a new series of all-stainless-steel ball bushings can operate in corrosive liquids and atmospheres. These anti-friction bearings can be used where oil cannot be tolerated because of contamination or high temperature.

These new ball bushings have free rolling characteristics which

practically eliminate friction and consequently preclude binding or chatter. Their low friction coefficient (0.002 to 0.004) practically eliminates wear and thus affords lasting precision alignment. Where zero shake or play is a necessity, extremely close and actual line-toline fits can be obtained between the bearing and the shaft.

Bearings will be manufactured for shaft diameters of \$\frac{1}{4}\$, \$\frac{1}{2}\$, \$\frac{1}{4}\$, 1, 11, 2, 21 and 3 in.-Thomson Industries, Inc., Manhasset, N. Y.



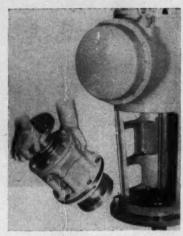
Spacer Coupling

Plugs large gap between shafts, connects quickly.

Where you've got a gap up to 12 in. between driving and driven shafts, chances are you'll find the Type F Steelflex coupling ideal. It acts as a spacer and can be disconnected or connected without moving either the motor or driven unit, and without disassembling the coupling. (see above).

To mount the coupling you first press the shaft hubs onto their respective shafts with lockwashers and heat-treated capscrews in place. Then position shaft hubs so that when Steelflex Spacer has been compressed to eliminate its gap it will slide between the hubs. After checking for minimum misalignment the Spacer can be inserted and fastened in place with cap screws.

Coupling is expected to find particular acceptance for connecting process pumps to motors.-The Falk Corp., Milwaukee, Wis.



Mixer Shaft Seal

Prevents escape of liquid, gas or vapor from tank.

Long service without adjustment is claimed for a new rotary mechanical shaft seal. Constructed as an easily-replaceable cartridge assembly the new seal is designed especially for liquid mixing service.

If a seal needs to be replaced you can uncouple it, remove it and install a replacement within minutes using only a wrench. Shafts align automatically and need not be checked. Mixer need not be moved or dismantled or tank contents removed.

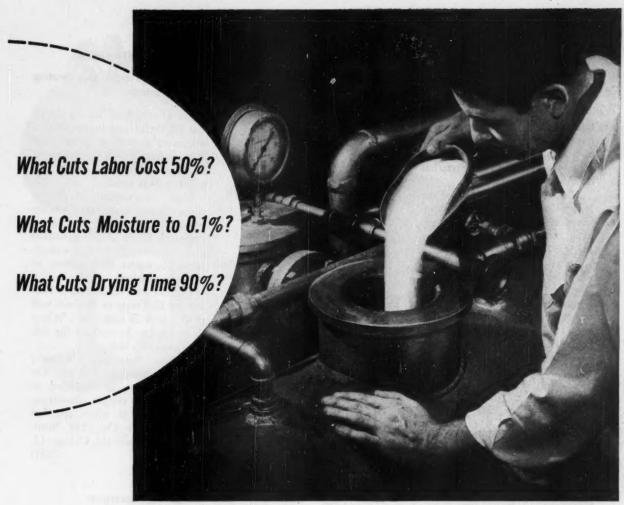
A locking collar arrangement allows seal to be replaced, without loss of product or pressure, where mixer is entirely below the liquid level or is installed on a pressure vessel.

Available types of seals are suitable for pressures up to 1,200 psig. and temperatures from -120 to +485 F. Construction materials include stainless steel, Stellite, bronze, ceramic, Hastelloy and Teflon.-Mixing Equipment Co., Inc., 158 Mt. Read Blvd., Rochester 11, N. Y.

For More Information ... about any item



in this department. circle its code number on the Reader Service Postcard inside the back cover.



Operator loads Rotary Vacuum Dryer in Stokes pilot plant.

Labor and time are reduced 50% by vacuum drying of a mixture of acetyl salicylic acid and other chemicals.

Sodium trichloracetate is reduced from 35% to 0.1% moisture content in 8 to 12 hours by vacuum drying.

Several makers of powdered aluminum and brass avert fire and explosion hazards by drying powders and solvents in vacuum . . . then recover 99% or more of the solvent in the same process.

Shellac is dried in vacuum in 6 to 8 hours per batch, a job that formerly took 72 hours!

Stokes has the laboratory and pilot plant facilities to test vacuum drying of any product which offers drying difficulties. Methods, cycles, equipment, costs will be accurately determined. Stokes has 40 years' experience in vacuum technology to share with you on drying problems.

Send for an informative brochure, "Vacuum Drying," on the techniques of moisture removal from chemicals, pharmaceuticals and other industrial products.

F. J. STOKES MACHINE COMPANY PHILADELPHIA 20, PA.



STOKES MAKES: High Vacuum Equipment, Vacuum Pumps and Gages/Industrial Tabletting, Powder Metal and Plastics Moiding Presses/Pharmacostical Equipment

Steam Trap

Functions efficiently on low condensate loads.

On low, medium and high pressure steam service a new line of traps is said to operate efficiently even handling extremely low condensate loads. Even so, the trap has reasonably high capacity.

All working internal parts of the Hydro-Flex trap are of heavy stainless steel to withstand severe operating conditions. Design pressure is 2,500 psi. at 1,100 F.

A dual fulcrum is used to power the valve lever. A primary high-leverage fulcrum cracks the valve from its seat. Valve is opened wide by a secondary low-leverage fulcrum to give maximum unrestricted flow. This combination gives efficiency over a wide capacity range.—Strong, Carlisle & Hammond Co., 1392 West 3rd St., Cleveland 13, Ohio.



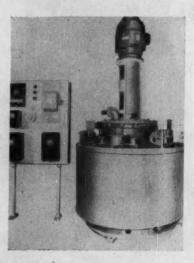
Heating Tape

Can be stretched or squeezed around uneven surfaces.

Knitted electrothermal tape is moving from the laboratory onto the industrial scene. Typical of the surface it can heat is the single bend pipe shown above.

Current-carrying resistance-heating bands are insulated on both sides with layers of knitted glass yarn. This construction makes it safe to wind electrothermal tape on metal. Insulation on both sides minimizes heat losses.

Tape does not buckle and can be stretched or squeezed to fit the equipment being heated. Frequently it can be repositioned without rewinding. It comes in ½-, 1-, 2-, and 3½-in. widths in lengths of 2, 4, 6, and 8 ft.—Arthur S. LaPine & Co., 6001 South Knox Ave., Chicago 29, Ill. 256B



Hot Salt Heater

Fits pilot plant needs in 650-1,000 F. range.

Through circulation of hot salt the Beth-Tec unit can supply pilot plant requirements for process heat up to 250,000 Btu. per hr. It's an integrated process unit, complete with salt tank, electrical heaters, circulating pump and instrumentation for safety and control.

Tank is constructed of carbon steel and is completely insulated. Electrical immersion heaters are suspended individually from the tank cover and can be removed readily for repair or replacement. A cast-steel, submerged-impeller centrifugal pump mounted directly on the tank cover circulates the hot salt to the process.

Instrumentation is designed to provide flexible heat quantity and temperature level control. The panel board is wired to interlock controls for safety.—Bethlehem Foundry and Machine Co., Bethlehem, Pa. 256C

Standard Heaters

For high-speed tank heating of solutions.

For general fluid heating service the Hi-Therm grid heater offers a maximum amount of prime heat transfer surface in a limited space. Standard width 2½ in., height 31½ in., length as required.

High concentration of heating surface is said to outperform other types of tank heaters. Tubes are staggered. With a high conduction and convection factor this arrangement accelerates fluid motion to promote agitation.

In most cases for heating to boiling one Hi-Therm on the back wall of the tank is sufficient. Where desired it can be used on the side or bottom of a tank.

Normal construction is wrought steel pipe tested for 350 psi. On demand it can be furnished in stainless steel, copper, aluminum, nickel, brass or other specified metals.—Rempe Co., 340 North Sacramento Boulevard, Chicago 12, Ill. 256D

Heat Exchanger

Shell-and-tube type for heatsensitive materials.

A new model process heater of stainless steel heats high velocity flow rapidly. It's particularly applicable to heat-sensitive materials.

Basic shell and tube design provides for steam distribution and thermal expansion through a combination steam distributor, thermal expansion joint and baffled shell. Quick-opening heads expose internal surfaces for easy cleaning.

Instrumentation can be furnished to control discharge temperature of the product. To protect against burning, caused by flow stoppage, a vacuum system can be included. And to provide continuous high-velocity product flow a recirculation system is added.

Built in nine sizes the exchanger can be floor mounted and, if desired, connected in tandem.—Oscar Krenz, Inc., Ashby Ave. at 6th St., Berkeley 10, Calif. 256E



Get this new 44-page Crucible book, "Making the Most of Stainless Steels in the Chemical Process in-dustries." It's full of in-formation you'll be able to use in your daily work. Write today for your copy.



When solids have to be separated from liquids . . . when semidry cakes must be dislodged quickly and easily . . . and where minimum down time is vital-there's no unit like a horizontal pressure leaf filter. And when its materials must be strong enough to take rugged, continuous use without undue wear-there's no material like Crucible Rezistal® stainless steel.

In operation, horizontal filters like the one shown here, are cleaned by rolling out the leaves, and tapping with a rubber hammer. Crucible stainless leaves require no cloths-and seldom or never need to be replaced.

The story's the same with any process equipment. When you're choosing equipment that must stand up under heavy production schedules—take advantage of the proved reliability of Crucible stainless steel. Remember, too-Crucible . . . the world's leading producer of special purpose steels . . . is always ready to help you plan for new and different applications of stainless. So, for help of any kind-call Crucible.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking

STAINLESS STEELS

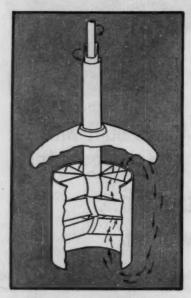
CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

Industrial Fans

For fumes, materials handling or high temperature gases.

A new line of industrial fans is designed particularly for maximum serviceability under corrosive and abrasive conditions.

Line incorporates highly efficient designs, new proportions conforming to latest NAFM standards and an increased range of 14 standard sizes. Wheel types can be chosen that fit best the specific application under consideration. Housing and wheels are constructed of welded steel.—Bayley Blower Co., 1817 South 66th St., Milwaukee 14, Wis. 258A



Industrial Mixer

Creates double shearing action without vortex

Many mixing operations can be speeded up with the new Shear-Flow mixer. Originally developed for mixing the more viscous textile inks it has since proven good for dispersing inks, paints, plastics and gums.

The mixing head produces a double shearing action that gives high-speed results at low rpm. Operating torque is low. There is no vortex and aeration is held to a minimum.

Mixer has two impellers and a

stator spaced closely together within a cylindrical housing. As the two impellers turn in opposite directions they pump material upward through the stator veins. Because the impellers are separated by only a small space and turn in opposite directions particles are broken up and dispersed by a shearing action.—Gabb Special Products, Div. of E. Horton & Son Co., Windsor Locks, Conn. 258B



Pipe Connector

Can withstand far more than pressure limits and bending moments in heaviest pipe.

All parts of the Graloc pipe connector are fully interchangeable and reuseable. You do not have to select gaskets, facings or bolts. For this reason it is tabbed a "onespecification" connection for all piping applications and pressure ratings.

The Graloc connector has a two-bolt clamp and a stored energy seal. A steel sealing ring, with flexible lips and a rigid rib, fits between steel connecting hubs attached to the ends of the pipe. Because of a difference in taper angle between lip and hub, the lip must flex to conform to the seat of the hub as the joint is made up. Thus the elasticity of the steel acts as a source of stored energy to maintain a positive seal. Internal line pressure increases the sealing effectiveness.

The two-bolt clamp works against tapered shoulders on the connecting hubs. Internal line pressure does not affect the bolting load.

Independent laboratory tests

have established Graloc as a leakproof seal for "any fluid at any temperature the pipe can carry." This includes light hydrocarbons, steam and even low molecularweight gases.

Standard Graloc connections are made in three styles: butt welding, slip-on and threaded in sizes from 1½ to 12 in. for all standard weights from schedules 40 through 160 or XX strong. They can be made for super pressure and of heat and corrosion-resistant material. — Gray Tool Co., P.O. Box 2291 (B15), Houston 1, Tex. 258C



Cheek Valve

Closes without slamming, has minimum flow resistance.

Through unique spring action a new check valve closes without hammering or chattering.

The swing-type flapper is closed by knuckle action with two springs acting at the joint of the knuckle. Spring tension on the flapper actually closes the valve an instant before reverse flow commences, eliminating slamming.

When the flapper is closed, mechanical advantage of the knuckle multiples spring pressure, holding the flapper tightly against the seat. As the flapper swings open, spring pressure tending to close the flapper actually decreases due to the knuckle construction. Thus there is minimum restriction to maximum flow through the valve.

Valves are supplied in 4, 6, and 8 in. dia. with flanged or threaded ends. Internals are stainless steel





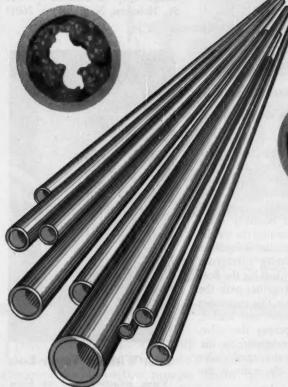




Time to replace old process lines









· Copper can't clog with rust!

Chase Copper Water Tube is corrosion-resistant—clean and smooth inside. Even paper pulp and other heavy industrial fluids flow freely through Chase Copper Water Tube.

Copper lasts longer!

Chase Copper Water Tube has proved its non-rusting qualities over the years. Installations made many years ago are still smooth and rust-free.

Copper is easy to install!

Chase Copper Water Tube is light in weight, comes in long lengths that require fewer joints. You can make leak-proof, pressure-tight solder-joints, using simple, standard soldering techniques.

For more information, contact your nearest Chase Wholesaler or one of the Chase Warehouses listed below.

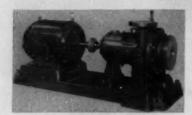
BRASS

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The Nation's Headquarters for Brass & Copper

with choice of aluminum, stainless steel or galvanized steel for the bodies.—W. R. Ames Co., 150 Hooper St., San Francisco, Calif.

258E



Process Pumps

Claimed to have standardized special features.

Features of centrifugal pump design normally considered as special have been standardized in the R-10 series of pumps. Included are components such as enclosed cradle; drain rim base; labyrinth, nonsparking bearing seals; rabbetted joints; alloy steel studs; and stuffing boxes interchangeably adapted to packing or mechanical seal.

In the R-10 series there are eleven pumps ranging in size from 1 x 2 in. to 4 x 6 in., yet one standard cradle assembly serves for all sizes. Size and capacity requirements are satisfied by varying only three parts: the casing, impeller and suction nozzle.

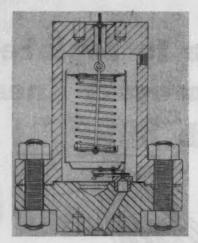
Every pump in the line is available in any of five standard material classifications. Special combinations are furnished on request.—
Dean Brothers Pumps, Inc., 323
West 10th St., Indianapolis 7,
Ind. 260A

Compressed Air Filter

Has transparent cylinder giving clear view of filter elements.

You can tell easily the proper time to replace filter elements or drain moisture when you've got a model 65C Sta-Dri separator on your air line. The cylinder walls are transparent plastic, 1-in. thick and tested to withstand over 600 psi. It is easy to see at a glance the condition of the interior.

Approximate cleaning capacity of the two silk-encased filters in the separator is a million cu. ft. Unit is recommended for use where compressed air for process must be absolutely clean and dry to maintain production and quality of product.—Beach Precision Parts Co., 120 Mechanic St., Boonton, N. J. 260B



High-Pressure Trap

For service on air and gas systems.

A new forged steel trap drains water from compressed air or gas systems up to 3,000 psig. where no gas loss is permissible.

A non-collapsible, spring-balanced open float normally holds the valve closed because the weight of water in the bucket compresses the spring. Entering condensate fills the trap body making the float more buoyant. Together with the spring compression this overcomes the weight of water and bucket. Bucket floats opening the valve, allowing the condensate to discharge. The water-sealed valve closes before all the water is discharged.

At 2,000 psig., capacity is 2,000 lb. per hr.—Armstrong Machine Works, Three Rivers, Mich. 260C

Plug Valve

Has renewable packing sleeve for reliability under pressure.

Available for the first time in the U.S. is a plug valve with a renewable packing sleeve that can be

retightened in use or replaced quickly and easily. The plug cannot jam and there is an unobstructed straight-through passage.

Asbestos packing sleeve can be inserted in the body as a single unit. A ridge on one side of the sleeve fits into a corresponding groove in the body; this keeps the ports always in line. Stainless-steel eyelets recessed in the sleeve prevent asbestos from squeezing into the ports, also prevent erosion of the packing.

Sleeve-packed plug cocks are working on steam at 800 psi. and 900 F.; saturated steam at 2,000 psi.; benzine at 3,000 psi.; and chemical plant gases and liquids at pressures up to 6,000 psi.—The Klinger Corp. of America, 95 River St., Hoboken, N. J. 260D



Fills Without Vapor Loss

Vapor collection head on filling spout enables General Petroleum's Los Angeles refinery to load tank trucks without vapor loss. As truck fills, vapor vents into collection head connected to reclaiming system. Transparency of head permits loader to see when compartment is full. When all L. A. refineries are equipped with these heads, total hydrocarbon emissions will be reduced 17 tons per day.—General Petroleum Corp., 612 South Flower, Los Angeles, Calif. 260E

Get & Advantages of GOOD PUMP Double PUN

PUMPS

Longer Shaft Sleeve Wear with cast shaft sleeves (not commercial tubing). Sleeves extend through the stuffing box and seal at the impeller hub.

Greater Rigidity with heavy horizontally split cast-iron casing construction. Suction and discharge nozzles located in lower half of casing for easy inspection without disturbing piping.

Easy Coupling Mounting with Magic-Grip quick change bushings for pump and drive shaft. Pin and rubber bushing type usually used.

Double Wearing Rings
— one on casing and one on a impeller hub — make it pos-

sible to renew original efficiency easily and economically.

Wide Choice of Materials is available for all types of service — iron, bronze, stainless steel and combinations.

Hand Finished Impeller is precision turned and carefully balanced to assure vibrationless operation and close wearing ring clearance. Ample Bearings — Ball bearings may be furnished for either oil or grease lubrication. Split shell bearings also available in larger sizes.

Generous Stuffing Box with sufficient packing to keep stuffing box maintenance low. Provision made for sealing water connection or grease seal if required.

HEAVY DUTY CONSTRUCTION with no skimping, no corner cutting is what you'll find in Allis-Chalmers double-suction pumps. Extra metal thicknesses, extra strong parts, extra features and extra careful workmanship add up to long life, low maintenance, and low cost per gallon pumped.

Every Allis-Chalmers double-suction pump is carefully tested on the most modern testing equipment in the industry. Each installation is individually engineered by men whose experience in thousands of pump installations will give exactly the right pump for your needs. Stock sizes from 10 to 7000 gpm with heads to 475 feet.

Complete Pumping Unit

Allis-Chalmers can furnish the complete installation — pump, motor, control and drive — all built of coordinated design and manufacture.

Whatever your pumping problem, call your A-C Authorized Distributor or District Office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 08B6146.

ALLIS-CHALMERS



TAPER-LOCK

OFF THE SHELF NO REBORING!

The shift series of the shift series o

Ready for the shaft, with no costly, time-consuming operations to make them fit. That's the big news about Dodge Taper-Lock Sprockets. Taper-Lock grips the shaft with the firmness of a shrunk-on fit, yet comes off easily. Bushings may be re-used. They come in sizes to meet most every application.

Taper-Lock Sprockets are available from Distributors' stocks in a complete range of B-type steel sprockets— 1/2" through 2" pitch. Dodge quality Roller Chain is packaged in 10-foot lengths—also available in 50-foot and 100-foot reels. Save time-save money-keep production rolling—get Dodge Taper-Lock Sprockets and Roller Chain from your Dodge Distributor.

DODGE MANUFACTURING CORPORATION, 200 Union St., Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distribu tor, for valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone directory, or write us.



THERE'S ONLY ONE TAPER-LOCK, THE BUSHING THAT MOUNTS FLUSH!



Standardize; economize with Taper-Lock, the bushing that is interchangeable in Dodge sprockets; sheaves, couplings and conveyor pulleys. More than 2,000,000 in use!



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When you discuss solenoid valve requirements with an ASCO Engineer, you are benefiting from the design and development experience of half a century. The ASCO specialist can recommend the right valve for your needs because that leadership has resulted in the more than 1300 types of solenoid valves now available:

Two way valves in pipe sizes from ½" to 6" - for temperatures to 600° F. - for pressures to 1500 p.s.i.

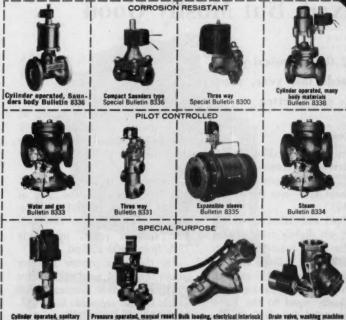
Three way valves in pipe sizes from $\frac{1}{8}$ " to 6" – for temperatures to 450° F. – for pressures to 1000 p.s.i.

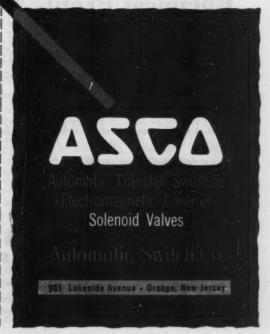
Four way valves in pipe sizes from ½" to 1½"—for temperatures to 212°F.—for pressures to 500 p.s.i.—poppet or slide type.

And ASCO can supply you with standard, explosion-proof or water tight enclosures—Class A and Class H coils—a wide range of body materials including cast iron, brass, bronze and stainless steel.

There's one source that solves virtually any solenoid valve problem—ASCO. Why not have the ASCO Engineer call—or write for your copy of ASCO Solenoid Valve Catalog No. 24.







How Chemical Process Companies Fared Last Year Sales Earnings Per Share Post-Tax Net Income ed Dollars) (Thousand Dolla Percent Percent 1953 Change Change 1954 1954 1953 1954 1953 545,561 - 4.6 Allied Chemical & Dye..... 530,777 - 9.7 45,172 \$4.80 \$5.01 43,072 Atlantic Refining..... 5.41 1.44 41,351 49,755 -16.94.47 Bristol-Meyers.... +41.8 3,603 2,540 2.12 n.a. 82,927 3,284 5,722 -43.1 3.69 Carborundum.... -13.3. Devoe & Raynolds1..... 48,008 48,957 1,334 3.06ª - 1.9 1,687 - 20.9 2.45 Dow Chemical (Six months)2. . 222,097 212,698 + 4.4 16,552 16,764 0.71 - 1.3 0.71 1,765,000 345,000° 235,565 +46.28 7.33 4.94 8,536 11,681 Freeport Sulphur..... 10,084 +18.1 4.20 3.56 n.a. 187,548 Hercules Powder..... 190,202 - 1.4 14,140 +21.1 5.10 4.20 Hooker Electrochemical¹.... 44,568 4,170 +15.23,378 0.95 38,693 1.90 +93.4 +23.30.53 International Minerals..... 22,282 20,509 + 8.6 1,444 1,171 0.58 Koppers...... 188,305 266,485 -29.36,125 9,026 -32.12.77 4.51 Monsanto Chemical 341,823 339,425 + 0.7 23,701 26,283 - 9.8 4.88 4.39 Norwich Pharmacal..... 1,456 20,794 18,896 +10.0 2,042 +40.2 2.27 1.61 Olin-Mathieson Chemical . . . 468,000 463,000 2.94 + 1.1 35,343 +11.03.11 Owens-Corning Fiberglas.... 136,470 131,745 8,412 5,356 +57.12.68 1.70 Phillips Petroleum...... 786,000 + 3.0 76,000 76,760 5.20 5.25 763,000 +18.5 11,860 14,931 10,637 16,157 73,303 +11.54.72 5.12 St. Regis Paper..... 200,090 2.62 2.91 200,334 - 0.1 Shell Oil..... + 4.9 121,000 115,400 4.40 4.20 1.94 1.01 Smith, Kline & French..... 9,382 4,913 +91.0Union Carbide & Carbon 923,693 1,025,833 -10.089,779 102,783 3.55 -12.7 West Virginia Pulp & Paper⁴. . 164,843 13,096 117,652 +40.1 10,736 +22.0 2.57 2.83

n.a.—not evailable; a Class A common; 3 Fiscal year ends Nov. 30; 3 Ends Nov. 30; 5 Estimated; 4 Fiscal year ends Oct. 31

Chemical Profits Mixed, But Mostly Good

Though sales and earnings of the chemical process industries didn't set many records last year, they stayed plenty high. And 1955 looks even better

William H. Chartener, McGraw-Hill Dept. of Economics

Steady business improvement during last year's final months enabled most companies in the chemical process industries to make a good showing in the year-end financial reports. And mostly, sales and profits hit close to the high figures reported for 1953.

Industry totals should be something like this when the final figures are available:

• Chemicals and Allied Products-Net sales up 1-2% over the 1953 total of \$17.3 billion; profits before taxes just about equal to 1953's \$2.4 billion; post-tax profits up about 15% over the \$1 billion of 1953.

• Paper and Allied Products— Net sales just slightly over the \$8.4 billion for 1953; before-tax profits off 1% from \$1 billion; after-tax profits up 5% from \$450 million.

• Petroleum Refining – Net sales virtually equal to the \$20.9 billion reported for 1953; profits before taxes down 6% from \$2.9 billion; profits after taxes off 2-3% from \$2.2 billion.

• Rubber Products—Net sales off 8% from the \$5.4 billion of 1953; pre-tax profits down 30% from \$475 million; post-tax profits about the same as 1953's \$200 million.

• Stone, Clay and Glass Products—Net sales about the same as the \$6.2 billion of 1953; before-tax profits up 4% from \$900 million; after-tax profits up nearly 25% from \$400 million.

For these five process industry groups combined, total net sales for 1954 will be almost identical to the \$58.2 billion reported for 1953. Before-tax profits will likely drop



Arc welding of the Filter/Separator.



It has been found that minute traces of water in aviation gasoline can stop the engine when flying in low temperatures, as at high altitudes, or over the pole. The amount of water involved is so small that it would not bother an automobile carburetor. To remove it for safe flying requires a special Filter/Separator. All metal parts going into this filter were specified to be 90-10 Cupro-Nickel. One of the contractors for the U. S. Navy is the Bendix-Skinner Division of the Bendix-Aviation Corporation, Royal Oak, Mich. When Bendix-Skinner obtained the order, it called in Revere's Technical Advisory Service. A complete study was made of the blueprints and specifications, in order to set up the most economical purchasing schedules. When production began, personnel from the Welding Section of the Research and Development Laboratory maintained by Revere in Rome, N. Y., went to the Bendix-Skinner plant to share their know-how with the welders, so as to be sure the welds would pass strict inspection, yet be made at competitive costs.

Cupro-Nickel, 90-10, is highly resistant to corrosion and other forms of attack. Because it contains only 10% uickel, it is more economical than the richer alloys, yet in many applications just as satisfactory. We suggest you look into it.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.;

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere. nearly 4% from \$7.6 billion, but after-tax profits should be up about 5% from \$4.3 billion.

▶ Big Difference: Excess Profits—The striking contrast between before and after-tax profits is almost entirely the result of expiration of the excess profits tax at the end of 1953. This extra levy bore heavily on growing companies in particular, thus had a very marked effect on the chemical process industries. Companies that have expanded rapidly in recent years could retain a larger share of their earnings in 1954.

Some individual companies that showed marked changes in pre-tax and post-tax earnings included Allied Chemical, Hercules Powder, Koppers, Norwich Pharmacal, Owens-Corning Fiberglas and Union Carbide.

▶ Depreciation Counts Heavily— Depreciation allowances also had a strong effect on profit margins in the process industries.

Capital investment has been high in the postwar years and, though there hasn't been time for the new depreciation formulas authorized in the 1954 tax law to show much effect, deductions under five-year emergency amortization certificates mounted rapidly in 1954. These deductions reduced tax liabilities for the year, but they also cut pre-tax earnings.

For the five process industries as a whole, total depreciation charges were up 8% over the 1953 total of \$2.6 billion. Emergency amortization charges alone were 29% higher in chemicals and allied products, 27% higher in paper and allied products, 40% higher in petroleum refining

Individual firms reporting substantial increases in depreciation, depletion and amortization include Allied (40%), Dow (16%), Hercules Powder (12%), Hooker (24%) and Union Carbide (24%).

Several companies reported lower pre-tax profits caused by increased costs and the inability to make proportionate price increases in the more competitive markets of 1954. Others, Allied for one, cite increased costs in connection with starting up new plants. But in the aggregate for the five process industry groups, roughly two-thirds of the drop in pre-tax profits can be attributed to higher depreciation and amortization charges.

▶ Still Selling Plenty—Sales figures of chemical companies reflect the fortunes of consuming industries:

Construction had a good year in 1954, and sales of companies making glass, paints and building materials held up well. Devoe & Raynolds and Owens-Corning Fiberglas are examples. Pulp and paper had a relatively good year too, which is reflected in reports of St. Regis and West Virginia Pulp and Paper.

Petroleum refining held even despite lower industrial activity. Increased motor vehicle population helped. And something of a freak in weather—slightly colder, but little snow to discourage motorists—boosted sales of both home heating fuels and gasoline during the final weeks of 1954. However, warmer

weather early in 1954 held down home heating fuel sales.

Sales dropped most where consuming industries-such as textiles, autos, rubber, steel and coal-were operating substantially below 1953 levels. The 10% drop in auto output was largely responsible for the drop in rubber and steel production. And lower steel output in turn meant lower coal requirements, which affected such things as explosives for mining. Firms selling large volumes of coke and ferroalloys to the steel industry-Koppers and Union Carbide, for instance-suffered relatively large declines in both sales and earnings.

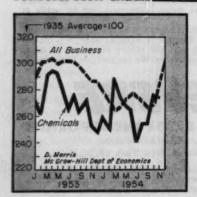
▶ Better This Year—Outlook for both sales and profits in the process industries is even better than the good showing for 1954.

• Higher Sales—Consumer industries that were weak in 1954 compared with 1953—autos, steel, textiles, for example—began 1955 at a faster pace. Construction promises to be even stronger than in its record year of 1954. And the pickup expected in general business activity will aid petroleum and paper products.

• Higher Profits—Markets have improved enough already to permit rayon price increases. A round of wage boosts is expected this spring and summer, but if demand holds up producers facing a squeeze should have an easier time passing on increased costs than they did last year.

 Efficiency Gains—The tremendous investment of the process industries in modernized plants

CONSUMPTION INDEX



Business Activity (Jan.)30

Chemical Consumption Dec. (Prelim.) . . 276.2

Nov. (Rev.)....274.4

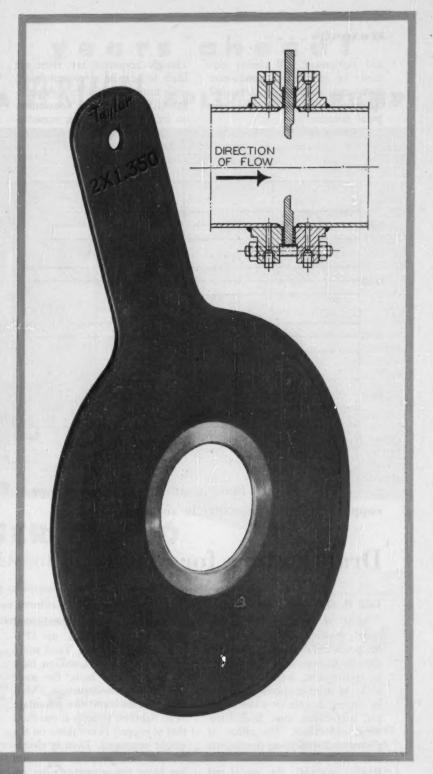
Indexes	Dec.	Nov.	Paint & varnish	22.58	24.80
Fertilizer	68.84	64.24	Textiles		
Pulp & paper	30.69	33.07	Coal products	11.57	10.87
Petroleum refining.	29.09	27.21	Leather	3.90	3.78
Iron & steel	15.19	14.84	Explosives	7.76	8.39
Rayon	29.23	28.57	Rubber	6.73	6.24
Glass	19.81	21.37	Plastics	21.02	20.89

New improved measurement of low flows with varying viscosity

AS A RESULT OF TAYLOR'S BROAD EXPERIENCE WITH QUADRANT EDGED ORIFICE

THE Quadrant Edged Orifice is the result of considerable effort to find a primary element suitable for low Reynolds number flow measurement. This type of flow is encountered when viscosity is a factor both in magnitude and variation. The orifice edge has a rounded approach on its upstream face which makes it practically insensitive to viscosity changes so long as the throat Reynolds number does not exceed 250,000. For all practical purposes it has a constant coefficient over the Reynolds number range of 5000 to 250,000. Calibration curves are therefore unnecessary-standard square root charts can be used even on low flows. This constant coefficient characteristic permits the use of an integrator in the recorder or a planimeter with the charts.

Our experience has shown that unusual machining skills are required to produce this type of orifice satisfactorily—the edge contour being extremely important. If you have flow measurement problems that could benefit from the use of this Quadrant Edged Orifice, we suggest you submit them to Taylor for analysis and recommendation. Meantime write for technical bulletin to Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.



Taylor
Instruments
MEAN ACCURACY FIRST

INDICATING, RECORDING, CONTROLLING

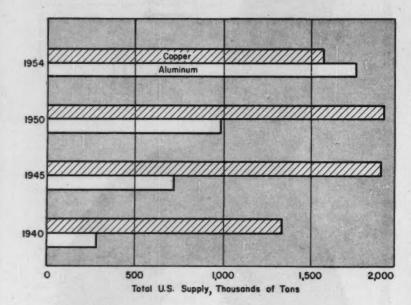
TEMPERATURE, PRESSURE, FLOW, LIQUID LEVEL,

SPEED, DENSITY, LOAD AND HUMIDITY

and equipment will almost certainly be reflected in production economics as they get into full operation. This should also help profit margins.

• Possible Tax Revision-

Though corporate tax rates are likely to be held at present levels, some firms may gain through possible U.S. government concessions on income from foreign manufacturing operations.



For the first time, aluminum production tops copper, the one bright spot in an otherwise . . .

Drab Picture for Metals

Cecil H. Chilton, Sr. Assoc. Editor

Most of the major industrial metals were off last year from earlier peaks, reflecting the general decline in business as well as a letup in construction activity and cutbacks in defense spending. Down by varying degrees were steel, copper, magnesium, zinc, lead, ferroalloys and cobalt. The effects of government stockpiling clouded the true supply-demand relations of a number of metals, e.g., nickel and titanium.

Brightest spot in the picture was aluminum, which continued its steady, healthy growth. The light, silvery metal made history last year by eclipsing copper for the first time in tonnage (total U. S. supplies).

Domestic primary production was 1.46 million tons, up 17% from the 1953 figure. Total world production was 3.12 million tons.

On a volume basis, the score was even more impressive. Most uses of aluminum take advantage of its lightness (density is one-third that of copper) to cut down on the weight consumed. Even in electrical uses, one pound of aluminum has twice the current-carrying capacity of a pound of copper. The 1954 aluminum supply, on a cu. ft. basis, was more than 50% greater than the combined volumes of copper, lead and zinc supplies.

► Titanium Paradox—Another metal showing appreciable gains was titanium. Output was more than

doubled in 1954 (5,250 tons vs. 2,250 tons for 1953).

This increased production brought about a seeming paradox of oversupply in face of repeated government pleas for more capacity. The situation boils down to this: Aircraft manufacturers can't afford to switch over to titanium for any given application on a partial basis; they must be able to count on adequate supplies of metal for complete changeover. Meanwhile, government stockpiling is taking up the slack.

Two years ago the defense goal was 22,000 tons by 1955. Probable production this year will be more like 8,800 tons, with the 22,000-ton mark still two years away. Although several titanium projects are in various stages of engineering or negotiation, the only one likely to figure significantly in this year's production is Crane Co.'s Cramet,

Inc., at Chattanooga.

Price reductions during 1954 no doubt reflected efforts to stimulate civilian uses of titanium. Although sponge price came down in two steps from \$5 to \$4.50 per lb., it's still a long way from the dreamed-

of dollar-a-pound goal.

▶ Optimism in Steel—Steel production in 1954 was off 21% from 1953 (total was 88 million tons), but the present upswing in demand portends a somewhat better showing in 1955. Predicted gains vary from 5 to 14 million tons. Even the most optimistic figure, however, is still well under the record 1953 figure of about 110 million tons.

Lagging steel production last year contributed to declines in consumption of ferroalloys and zinc.

▶ Copper for the Asking—Psychological warfare is now being used by the copper and brass industry to bolster demand. War-caused shortages left many consumers with the misconception that copper was still scarce.

Copper & Brass Research Association recently launched a campaign to combat this consumer viewpoint, pointing out that supplies are now adequate and can keep pace with expanding markets. Increasing competition from alumi-

years ahead! A VERTICAL SPLIT CASE PUMP FEATURES

B&G SERIES 1510

TYPE B CENTRIFUGAL PUMP

... with balanced loading of impeller and bearings... handles loads far in excess of those produced by any pump and motor combination! Easily serviced without breaking pipe connections!



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num no doubt underlies some of this promotional effort.

▶ Government Grabs Nickel—Despite increased free-world production of nickel in 1954 and continuing high demand, nonmilitary consumption went down. The reason: More went into government stockpiles. The U. S. imported 139,000 tons, used only 94,000, stockpiled the other 36,000. In 1953 the difference between imports and consumption was only 13,000 tons.

Unsatisfied demands for nickel will be discouraged very little by International Nickel Co.'s recent price hike of 41¢ per lb. Export price of electrolytic nickel from Port Colborne, Ont., is now 64½¢, including U. S. import duty of 1½¢.

Cobalt's position is like nickel's in one way—improved supply, lower consumption—but for a vastly different reason: Demand has taken a nosedive, with plenty of metal available to all comers. U. S. consumption last year was off 35% from 1953, chiefly because of declining use of cobalt in high-temperature alloys, permanent-magnet alloys and cemented carbides.

▶ Magnesium Shows Strength—A drop in magnesium production of only 7% in 1954—total production, 70,000 tons—was gratifying in the face of the post-Korea letdown. Dow looks for an increase in consumption of about 20% this year, which would make 1955 the best peacetime year in the history of the industry. Part of this increased output will be used as the reducing agent in titanium manufacture.

Dow renewed its lease on the Velasco, Tex., government-owned magnesium plant, after sale of this facility to Dow was blocked by a Justice Dept. antimonopoly ruling. Dow was the only bidder when the plant was put up for sale.

Mixed Pattern in Chemicals—Metal consumption by the chemical process industries for nonstructural uses shows no consistent pattern. Zinc oxide suffered a sharp decline last year. So did red lead and litharge, but white lead was up a bit. A small increase in tetraethyl lead helped balance lead consumption for chemical uses.

Oil Slacks, Will Improve

Better times are near, but last year's 1% rise in petroleum demand was well below normal.

Though demand for U.S. oil products didn't actually drop last year, the gain was minute. From its 1953 level of 7.63 million bpd., domestic petroleum demand rose only to about 7.75 million bpd.—up 1.6%. Exports of U.S. oil products dropped about 15%—from 352,000 bpd. to 301,000. So total demand in 1954 was 8.1 million bpd., 0.9% over 1953's 8.03 million bpd.

Main reasons for the slackening were the general economic decline and a warmer-than-normal heating season in the early months of the year. Fortunately, both these factors are already considerably improved. We've just come through a relatively cold winter, and nearly every segment of the economy is again producing at near-record levels.

▶ What 1955 Holds—There's little doubt that this year will be a happy one for petroleum. Total demand should hit close to 8.5 million bpd. —an increase of 4.8%—with domestic use rising to 8.18 million bpd., while exports stay at about 300,000 bpd. Capital spending for refining facilities will be down 7%—from \$767 million—but total spending by the oil industry (including production, transportation and marketing) in the U. S. will come pretty close to 1954's \$3.75 billion.

Also noteworthy are these predictions for 1955: Domestic crude oil production to rise from 7 million bpd. to 7.4 million; refinery crude runs up from 7 million bpd. to 7.28 million; oil well completions up about 450 from the 1954 total of 53,930 (about 38% of which were dry); jet fuel output up over 35%—to 180,000 bpd.; total refining capacity up from 8.6 million bpd. at the end of 1954 to 8.76 million by next January, with the accent on modernization.

► Same Old Problems—As in the past few years, U. S. oil industry has two major economic difficulties—excess refining capacity and dissension on oil imports. Neither is likely to be settled this year.

Spare refining capacity is now about 15% of the total. But most oilmen agree that national security needs make this cushion unavoidable and that the industry is wise enough to deal with it.

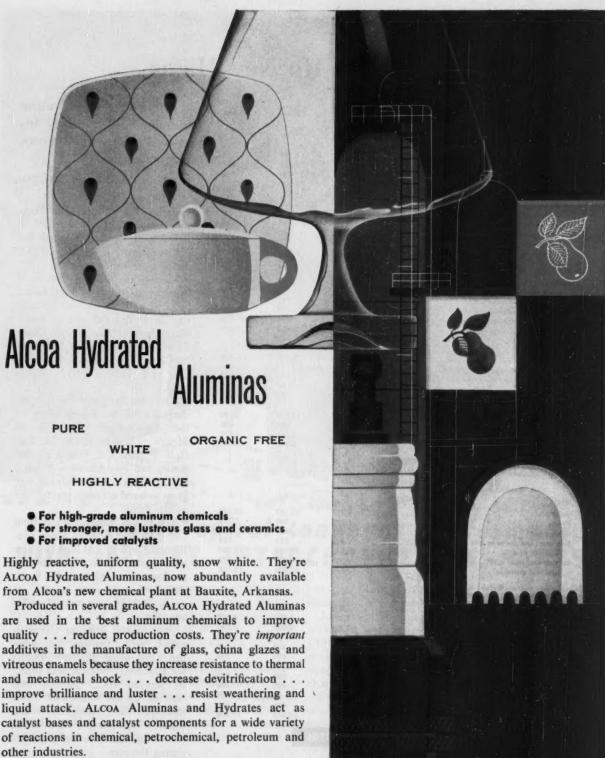
On imports the industry is split into two fighting-mad camps.

Producers who operate only in the U. S. say growing imports have caused domestic cutbacks. While imports rose to 1.06 million bpd. in 1954—up 1%—domestic crude oil output dropped about 2%—to 7.01 million bpd. In 1955 imports will average 1.13 million bpd. These firms are pushing hard for regulatory legislation.

Companies that produce both here and abroad argue that, while we must have high domestic production, it's also imperative that we develop foreign oil to conserve U.S. reserves and to assure supply in case of war.

▶ Refining Trends—Still much in the limelight is the huge increase in U. S. catalytic reforming capacity. This rose from 94,000 bpd. to 670,000 bpd. during 1954. And enough plants are already either under construction or definitely planned to boost the total to one million bpd. this year.

Not so far along, but growing steadily, are the prospects for economic production of oil from shale deposits. Last year Union Oil of California decided to build a commercial shale oil extraction plant, is now erecting a \$5 million pilot plant at Rifle, Colo. And several other firms, notably Texaco, are known to be working hard on improved shale oil recovery processes.



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ALUMINUM COMPANY OF AMERICA

Sulfur, Acid Outputs Hit New Highs

U. S. Sulfur Balance	1952	1953	1954
(Est. Thousand Long Tons, Sulfur Equiv.)	(Rev.)	(Rev.)	(Prolim.)
Sources, Brimstone and Sour Gas			
Sulfur mined (Fresch)	5,293	5,155	5,516
Producers' year-and stocks		3,022	3,228
Change in producers' stocks		-47 5,902	+206 5,310
Sulfur produced from HrS		337	357
Producers' year-end stocks		107	109
Change in producers' stocks		+12	+2
Apparent H:S sulfur sales	223	324 10	356 50
Withdrawn from users' stocks		-10	79
Total apparent sulfur supply	5,285	5,536	5,795
Sources, Pyrites, Gases, Sludge			
Imported pyrites	133	90	25
Domestic pyrites	397 267	3721 267	395
Sour gases and sludge to acid.	132	165	180
Total sulfur in alternates	929	894	900
Total equivalent sulfur supply	6,214	6,430	6,695
Disposition		-	
To exports	1,304	1,242	1,625
As sulfur.	900	1,010	990
As pyrites ¹	130	10	10
To acid As sulfur.	2.871	3,120	3,180
As alternates	929	894	890
Total to acid	3,800	4,014	4,070
Total disposition	6,214	6,430	6,695
U. S. Sulfuric Acid Balance			
(Est. Thousand Short Tons, 100% Acid)			
Sources			
Sulfur	9,325 1,725	10,127	10,310
Smelter gases	867	868	975
Sour gases and sludge to acid	420	532	585
Total new acid	12,345	13,027	13,200
Estimated recycled acid¹	2,300 14,645	2,273 15,300	1,900
Disposition (Gross Before Recovery)		POSTURES IN	
Fertilizer materials		100000	3919
Superphosphate and mixing	4,050	4,050	4,060
Chemicals	1,235 3,720	1,150 4,000	1,320
Petroleum refining	1,660	1,780	1,770
inorganic pigments	1,250	1,300	1,300
Rayon and filmiron and steel	635	670	620
Other metallurgical	840 990	1,010	850
Industrial explosives.	375	420	400
Textile finishing	30	30	30
Miscellaneous*,	630	670	650
Acid totals	14,645	15,300	15,100
Main Non-Acid Uses of Sulfu	r, Pyrites		
(Est. Thousand Long Tons, Sulfur Equiv.)			
Disposition Wood Data		9221	
Wood Pulp	200	390 ¹	400 ¹ 200
Other chemicals, dyes	90	95	90
Insecticides, fungicides	105	100	100
	75	80	75
Rubber		-	
RubberOther	135 980	135	1.000

Production of sulfur and new sulfuric acid increased from all sources except pyrites.

T. R. Olive, Sr. Assoc. Editor

Sulfur production from the 13 operating Frasch mines in Texas and Louisiana set a new record in 1954, reaching an estimated 5.5 million long tons, 4% above 1952, the best previous year.

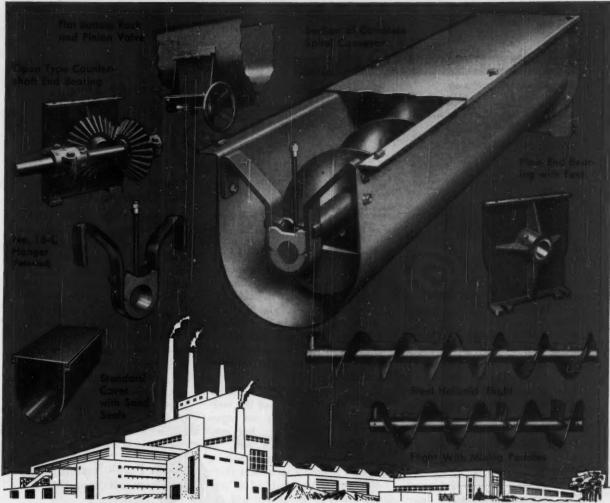
Most of the increase came from Freeport Sulphur's Grand Island Bay which turned out over 500,000 tons in its first full year of operation. Freeport also brought Nash dome into operation in 1954 and its Chacahoula dome in Louisiana has just now started operations.

Last year also saw the initial production from two Frasch mines on the Tehuantepec Peninsula of Mexico. These are run by Mexican Gulf Sulphur Co. (San Cristobal dome) and Pan American Sulphur Co. (Jaltipan). Gulf Sulphur Co. plans to build a Frasch plant at the Salinas dome.

▶ Non-Frasch Varies—Output from sour-gas sulfur recovery plants continues to inch up. At least two new units started up in 1954, so now we have about 40 such U. S. installations with total capacity of nearly 500,000 long tons of sulfur annually.

Due to the strike in Canadian mines, pyrites burning has dropped. But other alternate sources are increasing. Smelter acid capacity jumped about 200,000 tons (not all in use throughout 1954, however), and sludge-conversion capacity kept rising. The increases just about offset the loss in pyrites during the year.

Projects for recovery of sulfur from low-grade U. S. deposits are still being announced, but none looks especially hopeful except Anaconda's Yerington, Nev., copper project. There a low-grade ore (25-30%) from the Leviathan mine in California is converted to sulfuric acid by roasting in a Fluo-



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Sulfuric Acid Recycle Picture, 1950-1954

(Thousand Short Tons, 100% Acid)

	Reconstituted Sludge Acids	New Acid	Spent Refortified in Cont. Plents ²	Acid Reused as Such	Total Acid Available
1950	162	12,143	887	957	13,987
1951	233	12,389	984	1,216	14,689
1952	263	12,344	965	1,205	14,594
1953	3251	13,027	976	1,2973	15,300°
1954	375	13,200	725	1,175	15,100

Source: Business and Defense Services Administration except as noted.

² Sludge burned in sludge-conversion plants is reported as new acid, though it replaces an approximately equivalent amount of new sulfur.

² Spent used as drip acid in contact plants. Reported in "gross acid" by Bureau of Census.

Solids roaster. During its first full year of operation, this unit is estimated to have produced acid equivalent to about 50,000 long tons of sulfur.

► Supply-Use Balances — Over-all sulfur supply last year was appreciably greater than ever before (see tables p. 272). It came mainly from Frasch plants—80.3%. The rest included 6.3% from pyrites, 5.5% from H₂S sulfur, 4.5% from smelter gases, 2.7% from sludge conversion and H₂S-to-acid operations, and 0.7% from low-grade ores.

About 24% of the total supply was exported—exceptionally heavy because of stock-piling abroad. About 15% went to domestic nonacid uses and the remaining 61% to the manufacture of sulfuric acid in U. S. plants.

Production of new acid, estimated at 13.2 million short tons, was slightly larger than in 1953, the largest earlier year, despite the fact that total acid usage was down slightly. This production was distributed as follows: 78.1% from sulfur, 10.1% from pyrites, 7.4% from smelter gases, 4.4% from sour gases and sludge. Besides actual new acid, total supply included recycled acid equal to about one-seventh of the new acid.

First Recycle Statistics—Recycling of acid that's been diluted or contaminated by the process, but not consumed, has been practiced for many years. However, it's been on the rise recently, especially since the 1949-51 shortage. Yet only recently have fairly reliable data on the extent of this recycling

become available—through studies initiated by the National Production Authority four years ago.

These data have now been carried through 1952 by the Business and Defense Services Administration (Dept. of Commerce). The above table portrays the situation since 1950.

Although reconstituted sludge acid is properly a part of the overall recycle picture, it's not segregated in Census data, but considered as part of new acid. In addition, Census data include a separate figure for spent acid that's concentrated or refortified in contact plants by use as drip acid. So until now there have never been reliable data on the amount of spent acid reused directly without treatment. And this amounts to something like 9-10% of the new acid.

Familiar Acid Uses—The sulfuric acid end-use pattern in 1954 didn't differ much from that of the previous two years.* Total use was somewhat below 1953, with only slight decreases, or no change, in the various consuming industries except steel, down 16%, and superphosphate, up a shade. Acid use in fertilizers is edging up due to growing practice of adding acid and ammoniating during fertilizer mixing to produce ammonium sulfate in place.

At the same time, although there was some decrease in ammonium sulfate made at coke plants, this was much less severe than the drop in steel production and was more than made up for by a sharp boost in synthetic ammonium sulfate production. The result was the biggest total output of fertilizer material since 1950.

Russia Again Claims Big Chemical Growth

As usual, Russia says its production of chemical in 1954 set new records, topping goals by 3%. Compared with 1953, these output gains are claimed: caustic soda 11%, soda ash 10%, mineral fertilizers 16%, agricultural poisons 35%, dyes 7%, synthetic rubber 1%, alcohol 8%. No tonnage figures were revealed.

It's stated that 1954 plans were bettered for ammonia, nitrogen, fertilizers, superphosphates, dyes and synthetic rubber. Goals weren't met for calcium carbide and potash. Interesting, too, is that capital expenditures for chemicals fell below planned levels.

South Paces Nation In Chemical Spending

For the 12 months ending Oct. 31, 1954, three southern states—Texas, Florida and Louisiana—led all others in spending on new chemical plants. According to a survey by the Manufacturing Chemists' Association that included plants completed, under construction or planned, Texas was tops with plants valued at \$571.4 million. Florida and Louisiana followed with more than \$230 million each.

Also in the big ten were these: California (\$173.6 million), Ohio (\$170.3 million), Illinois (\$169.6 million), Pennsylvania (\$102.8 million), Michigan (\$97 million), West Virginia (\$74.4 million) and Virginia (\$71.7 million).

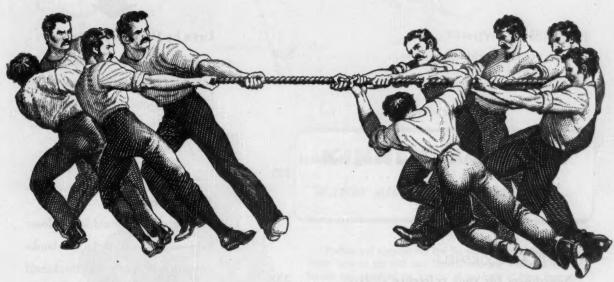
To Exploit Markets, Educate Consumers!

"A huge new market lies waiting for the drug and chemical trade fully 65% greater than was actually realized in 1954 sales—if, through

^{*}Chemical Engineering's 1952 figures have been revised to put them as nearly as possible on a comparable basis with BDSA data for 1952 (issued in 1954)

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great selling efforts, the multitude of families who have progressed in income since 1941 would take on the prewar consumption habits and desires of the income group into which they've moved."

This enticing forecast and challenge was made by Arno Johnson, vice president of J. Walter Thompson Co., to the Drug, Chemical and Allied Trades Section of the New York Board of Trade.

Getting more specific, Mr. Johnson stated that applying the 1941 spending pattern for drugs and toilet articles to today's spending

power indicates a potential 2\frac{2}{4} times as great as in 1941 in physical volume and four times greater in dollars. But to reach this prewar share of discretionary spending power would require doubling 1954 sales.

Brown Coal Held Good Electric Power Source

A new study by Arthur D. Little, Inc., Cambridge, Mass., indicates that the vast brown coal deposits of the upper Midwest are a potential source of electric power at rates that will compete with any others in the country. Thus the area is a good potential location for heavypower-consuming industries, particularly aluminum.

The lignite fields underlying western North Dakota, eastern Montana and northwestern South Dakota contain 12% of the estimated recoverable fuel reserves in the U. S. The report also points out that natural gas from the Williston Basin oil fields could well be the basis for petrochemical developments in the same area.

GUIDED TOUR CONTINUED



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Inside Back Cover

April 1955—CHEMICAL ENGINEERING

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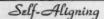


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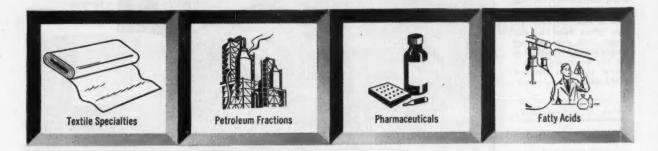
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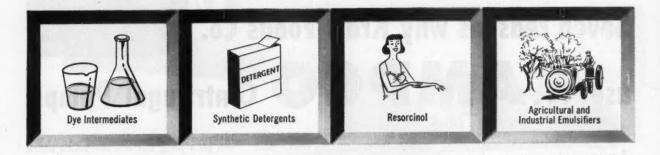
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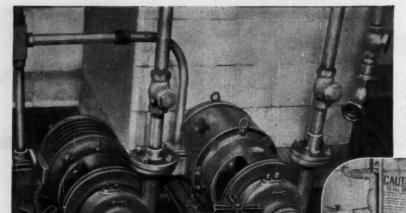
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6 Durametallic seals that resist wear — are easy to replace

7 Small space requirements

KRAFT uses corrosion-resistant Ampco Centrifugal Pumps to handle the vinegar used in the production of its mayonnaise and salad dressing. These pumps give a dependable flow rate... freedom from contamination... greater dependability...less downtime.

Moreover, Ampco Pumps are used throughout industry for difficult liquid-handling problems. They represent pump design at its best—both hydraulic and mechanical. They save power—have wide performance range, good characteristics, high efficiencies (up to 85%). They save money—you get a special pump at a standard pump price. They're built of Ampco Metal—the special alloys that make good where other metals fail. That's why they're unusually resistant to wear, corrosion, erosion,

cavitation-pitting, and deformation. That's why you get a pump that will successfully handle abrasive solids in suspension or viscous liquids.

Best of all, Ampco Pumps are productionbuilt, competitively-priced in a wide range of sizes. You can get them not only in Ampco Metal, but also in Illium "G" or other workable alloys to meet the requirements of unusual jobs.

Put these standard units to work for you—give them the tough jobs that formerly required high-priced special pumps. Take advantage of low-cost, long-life, headache-free pumping. Check with your nearby Ampco distributor or write us for the solution to your difficult fluid-handling problems.

*Reg. U. S. Pot. Off.

Clip this coupon to a postcard and mail today.

	and a series a some
Ampco N	letal, Inc.
MILV	VAUKEE 46, WISCONSIN
AMPCO	WEST COAST PLANT, BURBANK, CALIFORNIA
LET AMPCO P	ROVE ITS METAL

AMPCO METAL, INC., Dept. CE-4, N	lilwaukee 46, Wisconsin
☐ I'm interested in Ampco Centr P-3a.	ifugal Pumps. Send me bulletin No.
☐ I'd like to know more about A tries. Send me more information	mpco Metal for use in process indus- on.
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Company Address	***************************************
City	PR-14A

BACK IN THE 1840'S

WHEN MALTED MILK WAS FIRST INTRODUCED



WAS MAKING INDIVIDUALIZED CHEMICAL EQUIPMENT

Good news travels quickly—and only a few short years after its introduction, malted milk had become one of our favorite national refreshments. Yet—even before the first malted milk tablet was enjoyed—word-of-mouth recommendations by chemical manufacturers had already established KOVEN as one of America's fore-most steel fabricators. For over 70 years now, leading chemical plants have been achieving faster, more economical output with efficient KOVEN Individualized Equipment—built to their exact needs. See how KOVEN's accumulated skills and vast resources can help you in your race against time and costs. Call or write for a consultation—no obligation. Send for Bulletin #550.



X-RAY INSPECTION FOR QUALITY CONTROL

KOVEN equipment in all metals and alloys include: High pressure vessels, extractors, mixers, stills, kettles, tanks, stacks, breechings. Shop and field erected storage tanks. High vacuum testing.

PLANTS:



Jersey City, N. J.



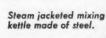
Dover, N. J



Specialists in:

- STAINLESS STEEL
- MONEL
- · NICKEL
- ALUMINUM
- · INCONEL
- ALL CLAD MATERIALS
 Fabrication to all A.S.M.E. Codes

L. O. KOVEN & BRO., INC. 154-A Ogden Ave., Jersey City 7, N. J.





COVEN FOR INDIVIDUALIZED EQUIPMENT SINCE 1881

The best answer to many corrosion problems ...

TITANI





End view of titanium diffuser. Note acid attack on cast iron flange.

Titanium steam jet diffuser easily passes 2 year acid test

Here's an instance of titanium's excellent performance under severe corrosive conditions. At a Du Pont Pigments plant a combination of chemical vapors and high-velocity steam proved too much for ordinary steam jet diffusers in service. Biting hydrochloric acid formed in the line and cut the service of cast iron diffusers to less than 3 months. Other diffusers of bronze and corrosion-resistant allovs were tried without improvement.

Finally, a diffuser of titanium was fabricated and installed. It's still on the job after a period of over 2 years of uninterrupted service-more than ten times the average life of other diffusers! And today, there's not a sign of wear or corrosion on the diffuser.

Resists chlorides and other corrosive chemicals as no other structural metal can!

Here are just a few of the corrosive environments where titanium offers corrosion resistance unmatched by common structural metals.

INORGANIC CHEMICALS	CONDITIONS	POSSIBLE APPLICATIONS
Ferric Chloride	0-30% at 100°C.	Process Piping,
Cupric Chloride	0-20% at 100°C.	Pumps, Valves,
Mercuric Chloride	All Conc. at 100°C.	Evaporators,
Aluminum Chloride	0-25% at 60°C.	Crystallizers,
Sodium Chloride	All Conc. at 100°C.	Kettles, Heat Exchangers
Sodium Hypochlorite	6% at 100°C.	Equipment for making
Chlorine Saturated Water	Room Temperature	Proportioning equipment
Wet Chlorine Gas	75°C.	Recovery equipment; electrolytic cells
Chromic Acid	10% and boiling	Plating equipment
Nitric Acid	0-70% at 100°C	Acid Heaters.
	60% at 195°C.	Nitrators
Sulphuric-Nitric Acid Mixture	40% sulphuric, 60% nitric at	and Auxiliaries
Nitric-Adipic Mixtures	38% nitric-17% adipic at 90-95°C.	Auxindries
ORGANIC CHEMICALS		
Chloroscetic Acid	100% at 100°C.	Chemical synthesis; equipment in manufacture of pharmaceuticals
Dichloroacetic Acid	100% at 100°C.	Chemical synthesis; equipment in manufacture of dve

You can start your own evaluation tests now

As a pioneer supplier of titanium sponge, Du Pont can offer you expert technical help or put you in touch with manufacturers best equipped to work along with you. Considerable fabricating know-how and a wide variety of mill shapes are now available to help solve your corrosion problems. For more detailed information on titanium, just check the coupon below.

PIONEERED COMMERCIALLY BY DU PONT



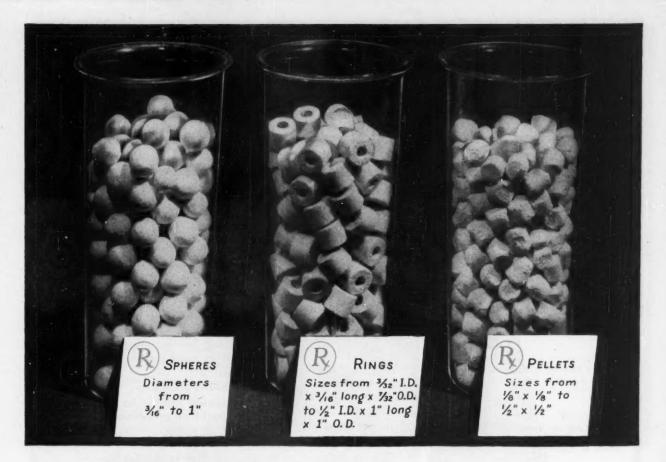
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E.	I.	du	Poni	de	Nemo	urs &	Co.	(Inc.)
Pi	gm	eni	ts De	par	tment	CE-4		
W	iln	nime	zton !	18	Delaws	re		

- Please send me your new technical bulletin on the corrosionresistant properties of titanium.
- Please send me your general booklet on titanium.

I am interested in using titanium for:,

Name	
Firm	Position
Address	
City	State



What are your catalyst carrier applications?

Norton engineered and prescribed carriers offer you important processing advantages

What do you need? An inert, high alumina carrier for fixed bed oxidation reactions — such as those involved in the manufacture of phthalic anhydride, maleic anhydride and ethylene oxide?

An inert, low density carrier for use

as a space filler or tower packing?
Norton ALUNDUM* fused alpha alumina carriers are proving highly successful in such processes. Containing 77% to 89% alumina, they are outstanding for chemical stability and resistance to abrasion and erosion - and their low density is a valuable quality in packing and filling applications.

ALUNDUM carriers are commercially available in the form of spheres, rings and pellets. Also available in experimental quantities are carriers made of magnorite*, crystolon*, Fused Stabilized Zirconia and Kyanite materials.

ALUNDUM Spherical Carriers

provide uniform beds in catalytic converters, reducing channeling and pressure drop to a minimum. Medium porosity spheres (40%-44%) have a network of open pores on the outside surface only. These are specifically recommended for applications where the carrier is coated with a catalyst. High porosity spheres (45%-49%) have an internal as well as external network of pores, and are suitable for applications where the carrier is impregnated with a catalyst.

Other Norton Refractories

for chemical processing include porous mediums, laboratory ware, ALUN-DUM, MAGNORITE, CRYSTOLON, and Fused Stabilized Zirconia shapes. All are engineered and prescribed to give you the best possible R — the most effective combination of physical

characteristics plus thermal, chemical and electrical properties. For details call in your Norton Refractories Engineer, or write, mentioning your specific requirements to Norton Com-PANY, 503 New Bond St., Worcester 6, Mass. Canadian Representative: A. P. Green Fire Brick Co., Ltd., Toronto. Canada.



REFRACTORIES

Engineered ... R ... Prescribed

Making better products ... to make your products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries



ENGINEERED... to provide positive protection against <u>your</u> specific <u>fire</u> hazard

Here is what a BLAW-KNOX AUTOMATIC FOG SYSTEM provides:

- -fire-fighting action starts immediately when rate of temperature rise is excessive
- -alarms sound
- -fire smothered promptly
- -heat dissipated rapidly by cooling action
- -pressure build-up prevented

A Blaw-Knox Automatic Fog System—designed to guard against your specific fire hazard—provides the most effective means of protection against destructive fire known. It is engineered to each special hazard, with the most effective devices and the best smothering action.

Why not let a Blaw-Knox Fire Protection Engineer study your needs? He will submit a layout and a cost estimate. Write or wire us now. There is no obligation.

Send for a copy of our booklet, "Fire Can Destroy Your Business." You'll find it full of interesting facts.

BLAW-KNOX FIRE PROTECTION SYSTEMS carry approvals of all insurance underwriters.

Deluge Systems • Wet Pipe Systems • Dry Pipe Systems • Water Spray and Fog Systems • Rate-of-Rise Sprinkler Systems • Foam and Carbon Dioxide Extinguisher Systems



BLAW-KNOX COMPANY

Power Piping and Sprinkler Division Pittsburgh 33, Pennsylvania A completely new and different

PAYLOADER[®]

TRACTOR SHOVEL



An efficient, more flexible bulk-material handling system

The first Model HA "PAYLOADER" tractor-shovel appeared 15 years ago, giving industry a new, flexible bulk-material handling system. Today, Model HA's are the bulk-handling system in thousands of plants.

Now comes the 1955 Model HA—a completely new design—with twice the digging power, lifting capacity and carrying capacity and 50 to 100% greater production capacity.

Whether or not you have older HA's—you should find out how this new HA can reduce your bulk material handling costs. Your "PAYLOADER" Distributor is ready to show you.



PAYLOADER[®]

THE PRANK G. HOUGH CO. . LIBERTYVILLE, ILL.



NEW HA

Outstanding features:

164/3 % more bucket capacity: PAYLOAD capacity 18 cu. ft. Struck-load capacity 14 cu. ft.

Powerful "break-out" digging action Upward rotation of the bucket combines with forward motion of machine in a powerful slicing action that gets full loads quickly, even from lumpy, sticky or heavy materials.

Bucket tip-back of 40 degrees when only 6 inches off the ground carries heaped loads *low* and *close* for maximum stability, balance and safety.

New standards of safety Boom arms and parts are mounted *low* and carry loads *low* and are always clear of the operator. Operator visibility is good at all times.

Advance-design hydraulic system includes: sealed, pressurized hydraulic tank — no breathing of dirt and grit into hydraulic fluid; hydraulic accumulator prevents pressure shocks — gives easier, safer control.

Torque-converter drive and full-reversing transmission with two speed ranges insures fast moves in either direction—easier operation and control—more production.

GAS OR DIESEL POWER OPTIONAL.

- ☐ Send me complete model HA information
- ☐ Send information on all seven "PAYLOADER" sizes
- ☐ Send name of my "PAYLOADER"
 Distributor

Name

Title

Company

Street or Box No.

City

State



can you match this with any one machine?

Ability to dig The Allis-Chalmers HD-5G Tractor Shovel is not merely a loader. It is a powerful excavator. It can dig into clay, break up and load hard-packed bulk chemicals. Bucket teeth and rear-mounted hydraulic ripper attachments are available to speed tough excavating jobs.

Ability to load fast With its big 11/4-cu-yd bucket — and the power to crowd it full — the HD-5G keeps loading and stockpiling jobs moving at peak production. Two-yard light materials bucket is available for snow, coal, and other light materials.

Ability to maneuver—in close quarters. It takes a crawler tractor to utilize such power and capacity in such a small space. The HD-5G pivots around within its own track length. Special high-speed reverse adds further to output on short-cycle jobs.

Ability to handle any load A wide variety of front-end attachments may be quickly interchanged with the standard bucket. Included are Lift Fork for packaged and palletized loads, Bulldozer for stripping and stockpiling, Crane Hooks for machinery and other heavy, solid objects, special Rock Buckets and Rock Forks. Drawbar is always available for heavy hauling jobs.

Ability to work anywhere any time
The HD-5G has stability to work
safely over rutted or uneven ground . . . traction and
flotation to travel through snow, mud, sand where
rubber-tired equipment cannot operate. It is the
ideal machine both for materials handling and yard
maintenance jobs.

Write for literature or ask your Allis-Chalmers dealer to tell you more about the versatility and flexibility of the HD-5G. Let him show you how its ability to switch from job to job — and to do each one well —can save you time, labor and specialized equipment.

ALLIS-CHALMERS

Your Imagination and Polyamide Resins Can Do Almost Anything



From Wheaties to industrial chemicals was not a big step for General Mills. The "know-how" that produced Wheaties played a large part in developing Polyamide Resins and other chemical products.

• General Mills Polyamide Resins are now among the most versatile of all chemical "ingredients." They are used in processing or formulating a remarkable range of products from shoes to fire retardant paints. They improve performance characteristics of glass laminates, foil coatings, papers, plastic films, modeling waxes, overprint varnishes, pottings and castings—to name a few. Nobody yet knows the total extent of their uses in cost-saving product improvement.

Have you a product that needs greater impermeability or better adhesion, more toughness or better wearing qualities? Consider the application of these versatile resins. Their narrow and highly controllable melting points, and the controllability of heat seal temperatures and hardness through blending of high and low melting point Polyamide Resins, add to their range of uses.

Polyamide Resins make excellent thermoplastic adhesives because they heat seal easily, bond at moderate temperatures, and set almost immediately. In addition, they are non-blocking, and have good heat and color stability. They are resistant to oils, commercial antifreeze, wax emulsions, detergents and other solvents, water and grease.

We'll be glad to work with you in developing any new adaptation of Polyamide Resins to solve a specific problem.

For detailed information, please send the coupon below.

We also manufacture a complete line of Fatty Nitrogen Compounds and Fatty Acids.

- PROGRESS THRU RESEARCH -----

General Mills CHEMICAL DIVISION

Please send me technical information on . . .

- ☐ Polyamide Resins
- ☐ Fatty Amines
- Fatty Acids

I am interested in using it for_

Name

Firm_

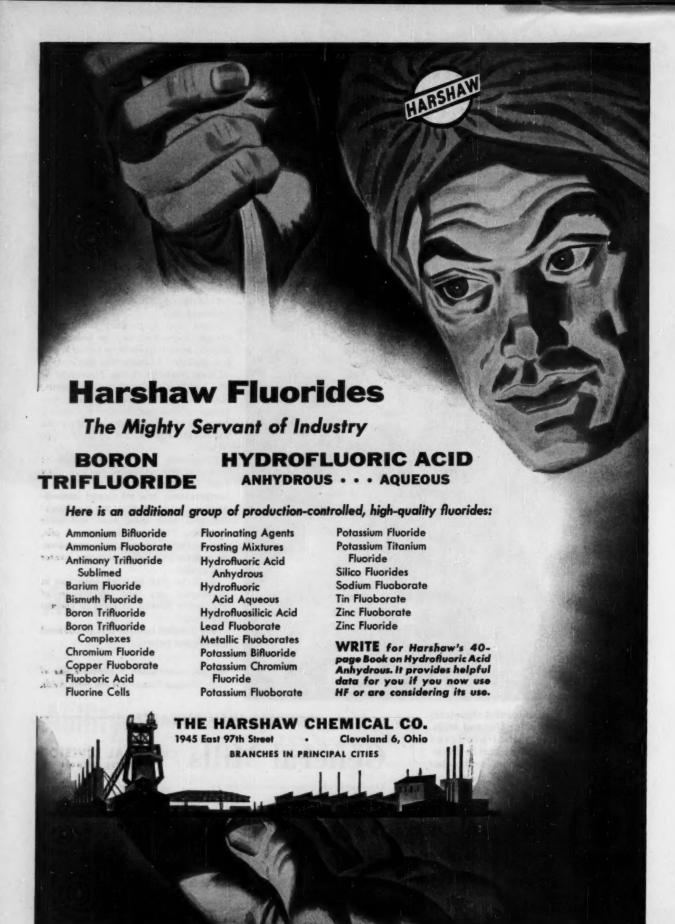
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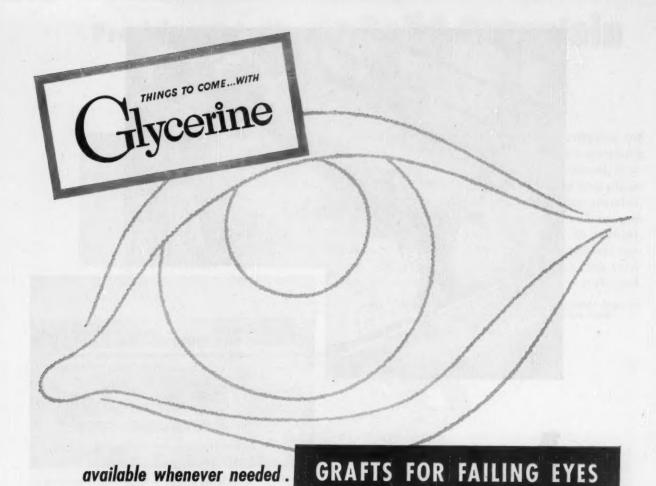
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E-4-55

CHEMICAL ENGINEERING—April 1955

SEND THIS COUPON





Imagine the tragedy in years past of corneal grafts spoiling after a few days storage-leaving none available when needed for surgery.

The future is more promising. Even stockpiling is a possibility, because scientists have found a way to preserve grafting material indefinitely, without affecting sight-restoring powers.

> The new technique, now being experimentally used in hospitals, relies on subzero temperatures—and saline solutions of Glycerine.

In medicine and pharmaceuticals, as well as many other fields, Glycerine's unique balance of properties continues to open new doors to progress. For tomorrow's surge of new specialties . . . in formulations and reactions yet unknown. Nothing takes the place of Glycerine.

This balanced group of properties keeps



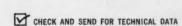
HYGROSCOPICITY . STABILITY .

SOLVENT POWER . VISCOSITY . NONVOLATILITY . NONTOXICITY . TASTE . MW/HYDROXYL RATIO .

HUMECTANT .

CARRIER · SOLVENT · LUBRICANT · SOFTENER ·

EMOLLIENT · ANTI-FREEZE · ALKYD BASE ·





20-page booklet on Glycerine for product conditioning



12-page booklet on Glycerine standards and specifications



16-page booklet on Glycerine properties and applications

For your free copy of any or all of these booklets write: GLYCERINE PRODUCERS' ASSOCIATION • 295 Madison Ave., New York 17, N. Y.



half mile of



A Mile of Shops — Each shop is devoted to a special type of heavy production. Included are complete Machine Shops, casting, forging and other facilities which offer all of the advantages of the execution of the complete job.

pressure vessels

These are two of seventy — over ½ mile — of 38½-foot vacuum tank casings built to meet the quality requirements of a well-known chemical maker.

The buyer also benefits from many savings made possible by Newport News extensive heavy fabrication equipment and the sixty years experience in using it.

Do you plan installations of heavy production equipment? You can command the services of Newport News for weldments of corrosion-resistant, alloy and clad metals in almost any size or shape, plus the required engineering background and complete welding and stress-relieving skills.

It will pay you to get the facts, shown in Facilities and Products. As you glance at its photos and brief captions, you'll see why Newport News can turn out — at low cost — specialized heavy equipment for chemical plants.

Send for Facilities and Products – free – today.

Newport News

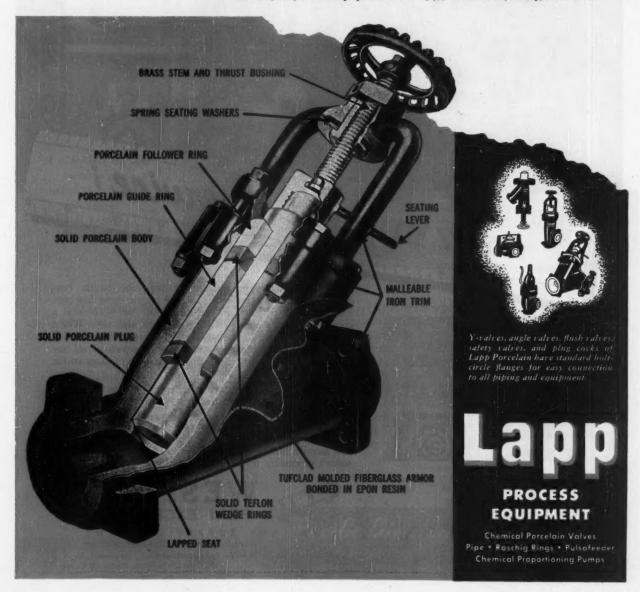
Shipbuilding and Dry Dock Company Newport News, Virginia

Precision Grinding of Solid Porcelain in the Lapp Valve



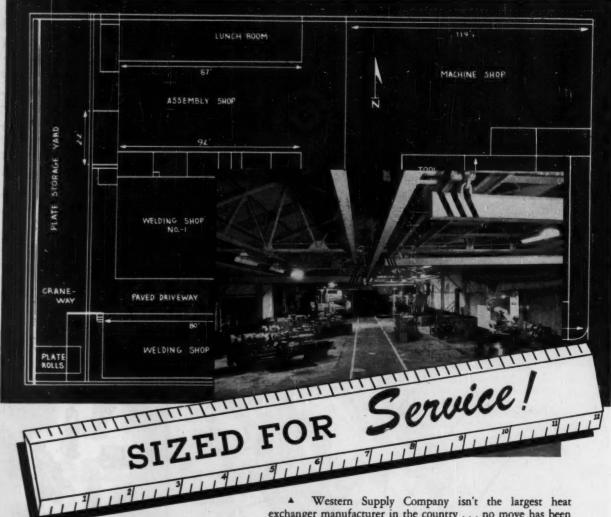
The high firing temperature, which assures complete vitrification and zero porosity of Lapp Porcelain, also makes impossible the maintaining of close dimensional tolerances. Necessary tolerances are achieved, however—in regular production ±.001"—by machine grinding with silicon carbide wheels. In the Lapp Valve, the entire stuffing box chamber, seating area, plug, guide and follower rings are finish ground, for precision assembly and complete interchangeability of parts. In addition, each porcelain plug is individually lapped and polished into its seat integral in the valve body. (No separable seating parts.) Each such valve seal is tested to 150 psi hydrostatic pressure before the valve is shipped.

Write for bulletin with complete description, characteristics, and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 413 Wendell St., LeRoy, New York.





ASYNOPSIS OF AD #1: Western Supply Company of Tulsa, Oklahoma, started as a small machine shop in 1906. The growth of the Southwestern oil country supported the small operation, and in 1936 Western began building heat exchangers for the pipeline industry. This specialized fabrication soon expanded to encompass the refining, chemical and petrochemical fields.



PROOF OF FLEXIBLE SERVICE . On October 29th of this year a prominent chemical company filed an emergency order for an Amine Reboiler. This unit was engineered, fabricated and delivered by November 15, just 17 days following the customer's desperate phone call. Naturally such short-term delivery is not a general rule, but is an excellent example of the speed which can be achieved when a company is not overwholmed by its own (built.)

2nd in a new series of advertisements

Western Supply Company isn't the largest heat exchanger manufacturer in the country . . . no move has been made nor any proposed in that direction. But Western is a company with a planned facilities program, and, since World War II, the addition of the latest mills, lathes, rolling, bending and welding equipment have earned it the reputation of one of the most modernly equipped heat exchanger plants in the United States.

Because of its moderate size and the degree of control it exercises over the heat exchangers it is to build, the plant is truly "sized for service" and offers its customers a flexibility and speed invaluable on emergency or deadline fabrication. Working in both common and alloy metals, Western designs and manufactures for the high pressures and temperatures of today's processing requirements.



WESTERN SUPPLY COMPANY
P. O. BOX 1888 • TULSA, OKLAHOMA

HUDSON-RUSH COMPANY—753 Gladstone Blvd., Shreveport, La.
130 Casa Linda Plaza, Dallas 18, Texas
PROCESS INSTRUMENTS & EQUIP. CO. - North Bldg., Charleston, W. Va.



This new simplified digital gaging system remotely measures liquid levels in any number of tanks over a single wire pair of any length.

As illustrated, levels from the dialed tank are read from float-type gages and transmitted in precise digital form to the tank gage receiver. Tank number and level readings, in feet, inches and eighths, are displayed on easy-to-read lamp registers. Continuous monitoring or read-and-hold can be selected as desired. Optional features include automatic sequencing of tank selection, printed

read-out by electric typewriter, and operation of card-punch apparatus.

Under the Bendix-Pacific unitized construction, these systems are comprised of standard assemblies offering maximum flexibility with low cost. Utmost reliability, freedom from error, and long-term unattended life are inherent qualities of the ELECTRO-SPAN system.

Engineering facilities are available for application of ELECTRO-SPAN to your specific requirements. Your inquiry is invited.

Please address inquiries to: Dept. 831





how

FILM MAKERS
CUT CASTING,
CHILLING,
DRYING COSTS

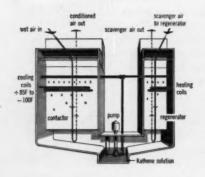
The leading manufacturers of photographic film and paper needed dry air at low temperatures for their casting, chilling, and drying processes. And they wanted it without frost, excessive reheating or aftercooling, high power requirements, carry-over, corrosion, and high maintenance and service costs.

They obtained air at the precise conditions they wanted by installing Kathabar humidity conditioning units, and avoided problems common to other dehumidification systems. For the casting process, where film dope changes from a viscous liquid to a transparent strip, Kathabar units deliver air at 104F and 47.5 grains/lb. with 53F water. For chilling the emulsion, they deliver air at 6.5F, 5 grains/lb., frost-free with OF refrigerant. For drying the emulsion, they provide 140F, 36-grain air, with 75F water.

The results have been better process control, improved product quality, and lower costs. One manufacturer, for example, saved \$40,000 annually in excess refrigeration by using Kathabar units for drying photographic paper.

Similar results have been achieved with Kathabar units in other industries: foods, pharmaceuticals, petrochemicals, brewing, glue, candy, atomic energy, lithography. For details, write for Literature Group K54-1C, including our just-published brochure, "HUMIDITY CONDITIONING."

WHAT COULD BE SIMPLER?



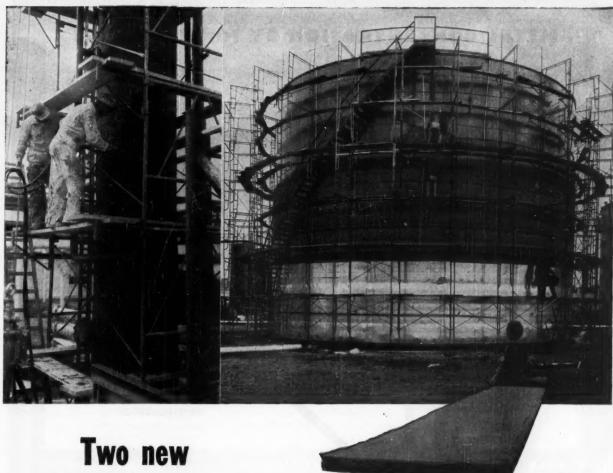
Air to be conditioned passes through the contactor, where an absorbent solution removes moisture (the amount depends on the automatically-controlled temperature of the solution). In the automatic regeneration, about 15% of the solution is heated, and the moisture it releases is blown out the window.



SURFACE COMBUSTION CORPORATION . TOLEDO 1, OHIO

ALSO MAKERS OF Surface INDUSTRIAL FURNACES

Janitrol AUTOMATIC SPACE HEATING



Two new techniques revolutionize the insulation of tanks, vats and vessels...

... and both of these new low-cost methods involve the use of ULTRALITE*, the long fine glass fiber insulation.

For large storage tanks, the most economical method is to cut long strips of ULTRALITE, run them around the tank (or from top to bottom) and cover with metal jacketing. On smaller vessels, like the fractionating column pictured, the common practice is to wrap with ULTRALITE, apply a mesh screen, and spray with weatherproofing materials.

Either of these ULTRALITE methods requires only a fraction of the time that would be spent in cutting, fitting and applying rigid segmental blocks or bats. Once applied, there will be no cracking of the insulation when expansion and contraction take place, for ULTRALITE is flexible and resilient. Best of all, your insulation is permanent, for ULTRALITE is as enduring as glass itself.

Like to receive complete details on these methods that will save you a good deal of time and money on that next insulating job? Just write today—or better yet, call your local ULTRALITE distributor in any of 57 cities. You'll find him listed in the Yellow Pages under "Gustin-Bacon Insulations."

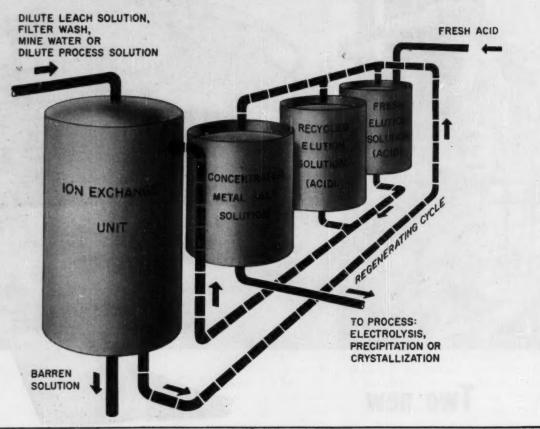
*Reg. U.S. Pat. Off.

GUSTIN-BAGON Manufacturing Company G



Thermal and acoustical glass fiber insulations . Pipe Couplings and fittings . Railroad gaskets and supplies

METAL CONCENTRATION BY ION EXCHANGE



The Permutit Company

Ion Exchange gives Better Yields

• Ion exchange increases yields, simplifies flow sheets and cuts labor, supervision and chemical costs when used with other hydrometallurgical processes such as Leaching, Clarification, Filtration, Purification, Precipitation and Electrolysis.

The simplified flow diagram shown above illustrates the main principles of ion exchange in concentrating metals from leach liquors, filter washes, other dilute process solutions or mine waters:

As the feed solution or mine water passes through the ion exchange unit, the metal values are concentrated on the ion exchange resin, generally in preference to other ions present, leaving the solution or mine water metalfree. When the metal-attracting property of the resin is exhausted, an appropriate elution solution, for example an acid, is passed through the resin to pick up the metal. In most cases, the elution solution also acts as regenerant to restore the metal-attracting capacity of the resin . . . as shown on the diagram. Recycling the elution solution provides high concentrations . . . often several thousand times as concentrated as the original feed solution.

Ion Exchange methods apply to these metals:

Base Metals	Minor Metals	Precious Metals
Copper	Cobalt	Gold
Zinc	Tungsten	Silver
Lead	Molybdenum	Platinum
Tin	Vanadium	Rare Earths
Aluminum	Decorative Metals	Lanthanide Group
	Nickel	Actinide Group
	Chromium	Uranium

The Permutit Company not only designs and builds complete ion exchange systems, but also manufactures ion exchange resins and zeolites for all industrial applications. For information, write: The Permutit Company, Dept. CE-4, 330 West 42nd St., New York 36, N. Y.

PERMUTIT Rhymes with "Compute it"

POWELL VALVES ... THE COMPLETE QUALITY LINE ... POWELL VALVES

FIG. 2342—Flanged End Bolted Cap Swing Check Valve. For 150 Pounds W.P.



LINE

QUALITY

COMPLETE

THE

VALVES ...

POWELL

LINE

QUALITY

COMPLETE

THE

Fig. 2309—Flush Bottom Tank Valve for 150 Pounds W. P. Disc Opens Into Tank.

FIG. 2495 (Sectional)— Stainless Steel O. S. & Y. Gate Valve For 150 Pounds W. P. Double Wedge Disc Is Accurately Guided Into Seat.

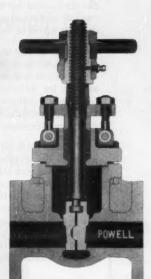
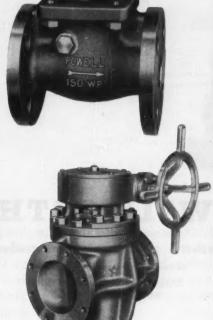


FIG. 3059-G—300-Pound Steel Lubricated Plug Valve. Gear Operated.



POWELL VALVES ... THE COMPLETE QUALITY LINE ... POWELL VALVES

Why Chemical Engineers Specify Powell Valves...

... because they know Powell Valves are dependable and economical. Chemical engineers also know that Powell has the COMPLETE quality line of valves.

Investigate the many outstanding features of the Powell Valves shown here... as well as the complete line of quality valves that have a proven record of long life and dependable service.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have.

The Wm. Powell Company, Cincinnati 22, Ohio 109th year

POWELL VALVES

CHEMICAL ENGINEERING—April 1955

297

POWELL VALVES ... THE

COMPLETE QUALITY

LINE

"Under Way On Nuclear Power"

As she blinked this terse message, the USS Nautilus cast off and steamed to sea leaving an old era of oceanic travel in its wake.

This is the first nuclear-powered, steam-turbine-driven submarine ever to be built. With the eyes of the world watching, it was a project with no margin for failure. Exhaustive sea trials which tested every feature of her equipment proved that the only acceptable result—success—had been completely realized.

We take pride in Walworth's share in this momentous achievement. For, from the days when the Nautilus was still on the drawing board to the last stage of construction, Walworth engineers worked directly with the Electric Boat Division of the General Dynamics Corporation—helping with the myriad of piping problems this new concept of transportation posed. Now the Nautilus prepares to join the fleet with Walworth Valves and Fittings, both standard and special items, installed.

We are glad to be aboard.

Manufacturers since 1842

valves...pipe fittings...pipe wrenches

WALWORTH

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS
THROUGHOUT THE WORLD



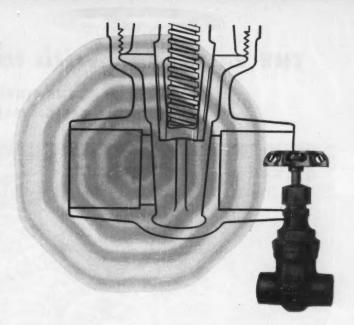
When the heat's on

you need the extra strength of

JENKINS

Solder and Socket End

VALVES



Solder End GLOBES and ANGLES

300 lbs. O.W.G. 4" to 3"

Fitted with Renewable Composition Disc.



Solder End GATES

225 lb. and 300 lb. O.W.G. 36" to 3"

With solid or split wedges, and stationary or traveling spindles.



Solder End CHECKS

300 lbs. O.W.G.

Regrinding. May be easily reground without removal from line.





NEW BULLETIN Lists all Jenkins Solder End and Socket End Valves and gives complete instructions for soldering and brazing. Ask for Solder-Socket End booklet. The "light-duty" look of copper tubing installations is deceiving. Valves must provide an accurate fit to tubing and *hold it* under the intense heat of soldering. And, because flexible tubing does not afford the rigid support of standard pipe, valves must withstand unusual strains in operation.

Jenkins Solder End Valves are engineered to meet these demands with strength to spare. High tensile bronze castings have liberal dimensions for extra rigidity. Smooth, clean bores assure accurate fit, easy soldering, positive seal to types K, L, and M Copper Tubing.

For faster, trouble-free installation, and lasting economy, specify Jenkins Solder End Valves. Jenkins Bros., 100 Park Ave., New York 17.



JENKINS Socket End Valves

for Class B or IPS Tubing

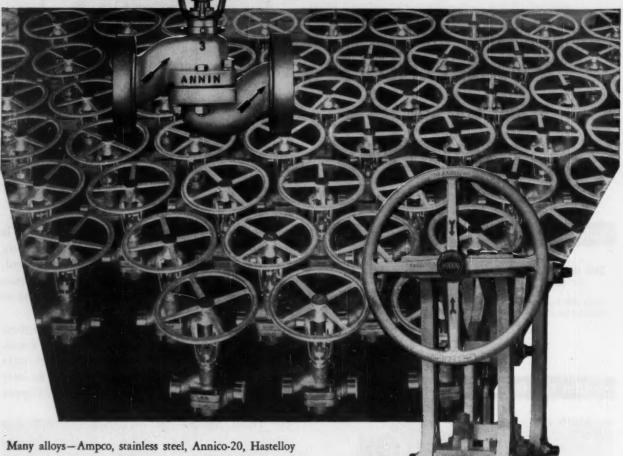
Jenkins bronze valves with socket ends for silver-brazing are made in Globe, Gate, and Swing Check patterns to control compressed air, hot oil, and similar fluids in tubing hookups where specifications call for permanent, leakproof joints. Complete information in the Bulletin offered below.



SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS

with more than 9 lives!

THE FINER ALLOYS PLUS OUTSTANDING DESIGN MAKE ANNIN VALVES LAST LONGER



Many alloys—Ampco, stainless steel, Annico-20, Hastelloy B and C—will serve you better when given the benefit of Annin's distinctive single seat body design. Annin valves are unexcelled for handling fluids that are erosive or corrosive in severe services. Lost motion between the handwheel and the valve plug has been eliminated. The one piece valve plug and stem is rigidly connected by means of the non-rotating stem lock to the operating screw, forming an integral operating unit. Here, for the first time, precise fluid control and positive closure is available in manually operated valves.

THE VALVE



AND AUTOMATIC VALVES in or pressures to 30,000 psi

THE ANNIN COMPANY 6570 EAST TELEGRAPH ROAD, LOS ANGELES 22, CALIF.



etter Things for Better Living

CHEMICAL ENGINEE

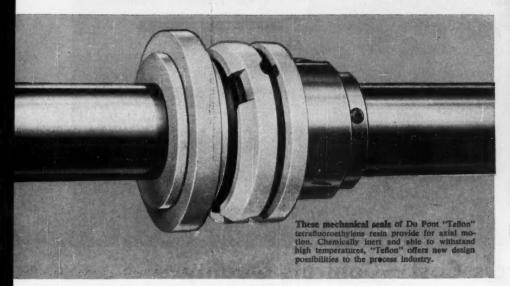
PROPERTY AND APPLICATION DATA ON THESE
VERSATILE ENGINEERING MATERIALS: "ZYTEL,"
"ALATHON," "TEFLON," "LUCITE."



NO. 3

1955

Mechanical Seals of TEFLON® Have Longer Life, Cost Less



Mechanical seals of Du Pont "Teflon" tetrafluoroethylene resin with an integral bellows provide a simple and economical seal for processing industries. These cost considerably less than other effective seals for similar applications and provide easy access for maintenance. Life expectancy is many times that of other seals or conventional packing.

The seals rotate with the shaft and eliminate scoring, and are the only ones which are designed to take axial motion. These seals of "Teffon" are designed to withstand temperatures up to 100°C. at 75 p.s.i., and 75° C. at 100 p.s.i. Fabricated in one piece, "Teflon" provides excellent wear resistance.

"Teflon" tetrafluoroethylene resin has complete immunity to corrosion and contamination. These mechanical seals have already performed with outstanding success in these applications: hydroxyacetic and sulfuric acids; adipic acid and hydrocarbon slurry; urea—NH₃ solution and water solution. When properly flushed, seals of "Teflon" can handle all abrasive materials normally encountered in industry.

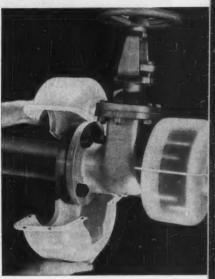
The versatile combination of properties of Du Pont "Teflon" tetrafluoroethylene resin-chemical inertness, high heat

resistance, low temperature toughness and low coefficient of friction—make this engineering material particularly adaptable to severe service conditions. Have you and your company investigated the properties of "Teflon"? By evaluating the properties in terms of your own design and service problems, you may find many ways to improve your product. Use the coupon on the right for complete information.

(These seals are manufactured by the United States Gasket Company, Camden, New Jersey)

NEED MORE INFORMATION?

CLIP THE COUPON for additional data on the properties and applications of these Du Pont engineering materials.



Flange Shields Molded of ALATHON are Installed Easily, Cut Maintenance

Transparent flange shields of Du Pont "Alathon" polyethylene resin have significant advantages over metal shields. They resist most chemicals, are lightweight and permit visual detection of leaks. Snap buttons of "Alathon" are molded on these shields for quick, easy installation and removal. "Alathon" provides economy in this application. Shields of "Alathon" are produced at less cost than metal shields, and require no maintenance. (Shields manufactured by Wilmington Plastics Company, Wilmington, Delaware.)

E. I. du Pont de Nemours &	Co. (Inc.)
	Room 254, Du Pont Building, Wilmington 98, Del.
	of Canada Limited, P. O. Box 660, Montreal, Quebec.
Please send me more inform	nation on the Du Pont engineering materials checked:
"Teflon"* tetrafluoroeth	ylene resin; "Alathon" polyethylene resin; "Zytel"
	ylene resin; "Alathon"* polyethylene resin; "Zytel"? rylic resin. I am interested in evaluating these materials for
nylon resin; ☐ "Lucite"* ac	rylic resin. I am interested in evaluating these materials for
nylon resin; ☐ "Lucite"* ac	
nylon resin; ☐ "Lucite"* ac	rylic resin. I am interested in evaluating these materials for
nylon resin; "Lucite"* ac Name Company	rylic resin. I am interested in evaluating these materials for



Controls Cost - Controls Quality

Here's a new money-saving tool for you who blend, batch or otherwise process alcohols, vegetable oils, deionized water and corrosive liquids. It's the popular all-stainless steel Rockwell Rotocycle meter fitted with a predetermining register and an automatic shut-off valve. You just set the quantity you wish the meter to dispense and when this quantity has been measured, the flow is stopped. The stainless steel control valve is of the multi-stage type to avoid hydraulic shock. Use the handy coupon for full details.

ROCKWELL

INDUSTRIAL

METERS



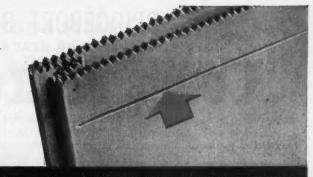
YOU CAN RELY ON ROCKWELL

ALL TYPES OF INDUSTRIAL METERS Rockwell makes all sizes and types of meters for use by industry. With them you can get positive metered accounting for a multitude of liquids. You can guard the quality of your formulations, keep tab on liquid inventories, have accurate records for cost control and tax analysis purposes. Now is the time to meter and save.

CLIP COUPON-MAIL TODAY

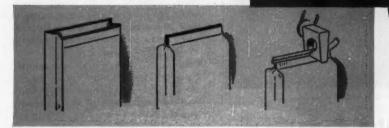
Rockwell Manufactur Pittsburgh 8, Pennsyl		*	104D
Gentlemen:			
I am interested in mea	suring		
		(Name of Liquid)	
Pipe Size			
Working Pressure	psi	Temperature	oF max
Max. Flow Rate	gpm	Min. Flow Rate	gpm.
YOUR NAME		1111	
COMPANY			
STREET			
CITY	zo	NESTATE	

Our pioneering pays off in profits for you



BAGPAK

MULTIWALLS



It's the Crease that does it!

- Makes bagtop forming easier
- Speeds Bag closing
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- Produces a better-looking package

Bagpak, the first to introduce multiwall bags to many industries, then improved them with the PREFORM top for easier, time-saving uniform closing. Now the PREFORM feature at the bottom means easier opening for faster, more complete filling.

You profit because your bags are filled, formed and closed in record time. You package bigger tonnage daily-and there's no waste.

Asking for complete information and prices places you under no obligation. Just write today to Dept. E-19



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BRANCH OFFICES: Atlanta - Baltimore - Baxter Springs, Kansas - Boston - Chicago - Cleveland - Dallas - Benver - Detroit - Kansas City, Kansas - Los Al Minneapolis · New Orleans · Philadelphia · Pittsburgh · St. Louis · San Francisco · IN CANADA: The Continental Paper Products, Ltd., Montreal,

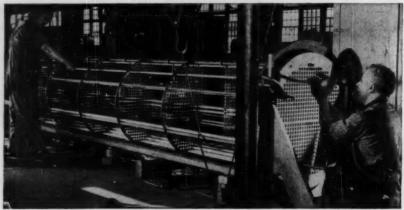
BRIDGEPORT BRASS COMPANY

CONDENSER AND HEAT EXCHANGER TUBE EDITION

COPPER ALLOY BULLETIN

Bridgeport

MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND. —IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL



Retubing a condenser with Bridgeport Condenser Tubes.

Condenser Tube Care Starts with Good Storage Practices

Stocking condenser tubes to facilitate repairs and minimize down-time is a practice which results in tangible operating and maintenance economies. However, proper methods of storage and handling are fundamental to long life and satisfactory performance from such replacements.

If you're not getting superior performance or long service from your replacement tubes, despite approved installation and operating practices, chances are that the tubes may have suffered damage prior to installation.

Proper Storage Techniques

 Tubes should be stored flat and in original shipping cases. Low stacks of cases are recommended to prevent damage to bottom tubes from excessive weight.

2) Storage locations should be both dry and protected, since extremes of temperature and humidity are detrimental. If necessary, storage areas should be dehumidified, using standard equipment readily available for this purpose.

 Avoid outdoor storage where corrosive fumes, soot, smoke, dirt and dampness can attack tubing surfaces.

4) Water-soaked cases or tubes require immediate drying out.

5) When stored in racks, tubes should

be supported at several points to prevent distortion from their own weight.

Manufacturer's Precautions against Damage

Bridgeport has realized the necessity for protecting its products against damage in transit, and from improper handling and storage after arrival at destination. For this reason, Bridgeport Condenser Tubes are shipped in cases of time-tested design, assuring their arrival in perfect condition. Their care, on receipt, becomes the responsibility of maintenance personnel. By maintaining proper storage requirements, as outlined above, tubes will remain undamaged. Since tubes often are stored for months, and occasionally for years, deviations from recommended methods may have serious effects.

However, observance of the best storage practices is worthless if improper or rough handling is permitted. Workmen should not walk on tubes. Such treatment may result in dents, digs, nicks, bends, twists or other distortions, all of which may predispose the tube to early failure under some conditions of service.

Effects of Improper Storage

As indicated, inside storage is preferred, but it offers no benefits to condenser tube protection if temperature and humidity extremes are permitted to exist. Cases absorb moisture and transfer it to the tubes. For this reason, if cases are allowed to rest on moist ground or wet floors, the contents are apt to be damaged. Tubes inside packing cases collect condensed moisture, which in turn picks up corrosive elements from the atmosphere, with possible damaging effects. Furthermore, white, green, blue and black salts, as well as red and black oxides, form on tube areas in contact with walls of moisture-laden cases.

In outside storage, tubes and assorted tube bundles are subjected to the full effect of atmospheric contaminants, such as dust, cinders, soot and corrosive gases. In addition, rain, snow, frost and dew accumulate on outside surfaces and tube ends. The combined action of moisture and atmospheric impurities has been found to result in damage to tubes, especially if storage under these conditions is prolonged.

Should outside storage be unavoidable, tubes should be covered by a tent or tarpaulin in tent form to protect them from weather and atmospheric deposits. In addition, vents should be provided at the tent peak to permit free circulation of air and promote evaporation of any interior moisture.

Failure Prevention by Inspection

Prevention of operational failures resulting from tubes weakened by improper storage is a simple maintenance procedure. This may be accomplished by having experienced personnel make periodic examinations of tubes stored on the bottom of piles, or in damp areas, to determine the corrosion rate.

The best method, however, is careful handling of replacement tubes and their storage under correct conditions.

Available to all users of condenser and heat exchanger tubes are the services of Bridgeport's Technical Service and Research Laboratory to help with corrosion problems and to recommend the best condenser tube alloy for each application. You may also obtain a copy of Bridgeport's Condenser and Heat Exchanger Tube Handbook, which contains valuable data on tubing problems and solutions—write for it today.

(3329)

six reasons why

HIGHER PRESSURE

means

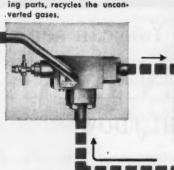
LOWER COST

in Casale Ammonia Synthesis

ONE COMPRESSOR installation does the whole job. No need for recycling or refrigeration



SIMPLE EJECTOR, with no moving parts, recycles the uncon-



CASALE CONVERTOR is a simple, steel re-action chamber with long-life catalyst.

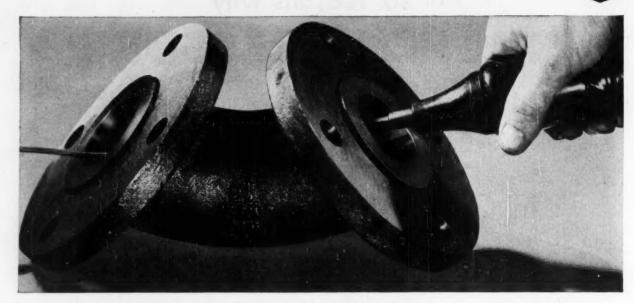
AMMONIA CON-DENSER operates at normal cooling water temperature.

- 7. First cost is greatly reduced by simplified piping and the much lower cost of the ejector in comparison to recirculating compressors.
- 2. Higher product yields are possible due to minimizing of the leakage which cannot be avoided when using recirculating compressors.
- 3. Oil contamination into the passing gases is eliminated. This condition is an inherent disadvantage of mechanical compression systems.
- 4. A simplified heat exchanger built into the reaction chamber eliminates outside heat exchanger and simplifies piping.
- 5. High operating pressure permits production of liquid anhydrous ammonia at normal cooling water temperature.
- 6. High operating pressure also provides greater reaction tolerance for carbon monoxide and oxygen contaminants in the synthesis gas.

HE CASALE process has been proved in more than 40 synthesis plants with a combined capacity of over 5,000 tons per day. In all cases, the operating pressure of 9,000 to 12,000 psig has been a definite economic advantage contributing to greater economy of installation and operation and maximum yields of pure, liquid anhydrous ammonia. Our long experience in this field is at your service. Write for Bulletin No. 0-54-1. Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.



FOSTER WHEELER



You can see why

SARAN LINED PIPE

KEEPS SHUTDOWNS TO A MINIMUM

It's made of corrosion-resistant saran pipe swaged into strong, rigid, nonbursting steel. And every piece is spark tested before you buy!

Unscheduled shutdowns are a thing of the past when you use saran lined pipe, fittings and valves to convey corrosive liquids. This modern, trouble-free piping is corrosion resistant... forms tight, snug, leakproof joints... won't burst under pressures up to 150 psi. And every single piece of saran lined pipe is carefully spark tested by hand to be sure that there are no pinpoint holidays or cracks in its lining. Cast steel lined fittings are available for higher pressures.

Installation costs are surprisingly low with saran lined pipes, fittings and valves, too. They can be cut and

threaded in the field with standard pipe-fitter's tools. Their rigidity means few supporting members are needed.

If you want to convey acids, alkalies, or other corrosive liquids at low over-all cost, be sure to investigate saran lined pipe. Contact the Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale 20, Michigan, Department SP528A.

RELATED SARAN PRODUCTS

Tank lining • Saran rubber molding stock • Saran tubing and fittings • Saran pipe and fittings.

SOME OF THE MANY

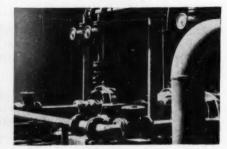
SARAN LINED

STEEL PIPE

Saran Lined Pipe is Manufactured by The Dow Chemical Company Midland, Michigan



A large Southeastern paper mill uses saran lined pipe to handle corrosive alum solution. It has proved to be an exceptionally satisfactory answer to eliminating unscheduled shutdowns.



This installation of a large Midwest company has conveyed highly corrosive hydrochloric acid for over seven years. The joints have remained as tight and leakproof as new.

you can depend on DOW PLASTICS

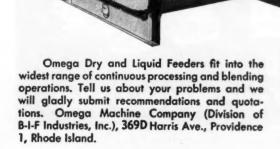




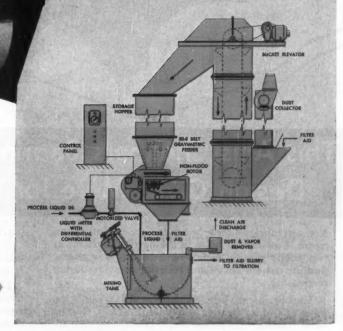
Filtration - an increasingly important operation in the food, petroleum, pharmaceutical, and chemical industries — is put on a mechanized basis with this "packaged" system for preparing filter aid slurry . . . one of the many Omega Feeding and Proportioning Systems available to industry today.

This system feeds finely pulverized filter aid (weighing 7 to 15 lbs. per cu. ft.) in step with the flow of process liquid to the filters. A sensitive synchronizing unit maintains the pre-selected ratio of dry material to liquid . . . keeps slurry concentration at the optimum level . . . eliminates hit-or-miss, high-cost manual preparation. It's an Omega System throughout — from the Model 50-8 Belt Gravimetric Feeder (accurate within ± 1% by weight) to the mixing tank, dust and vapor

> removal devices, synchronizing mechanism, and control panel. The design and construction of this "packaged" system is 100% an Omega responsibility which relieves the customer of the purchasing and engineering of individual components.



Continuous slurry preparation system including Omega 50-8 Belt Gravimetric Feeder with positive, non-flood feeding mechanism; mixing tank and agitotors; dust collector, bucket elevator, storage hopper; control panel and differential controller.



GATHE LAST FEEDE]



Here Is Extra Motor Value



You can lubricate these bearings without dismantling motor. Pipe-tapped holes in the bearing housings at two points provide means for inserting new grease, flushing out old grease and relieving pressure during re-greasing.

The bearing cap is held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor... retains an ample supply within the bearing enclosure... protects the grease and the

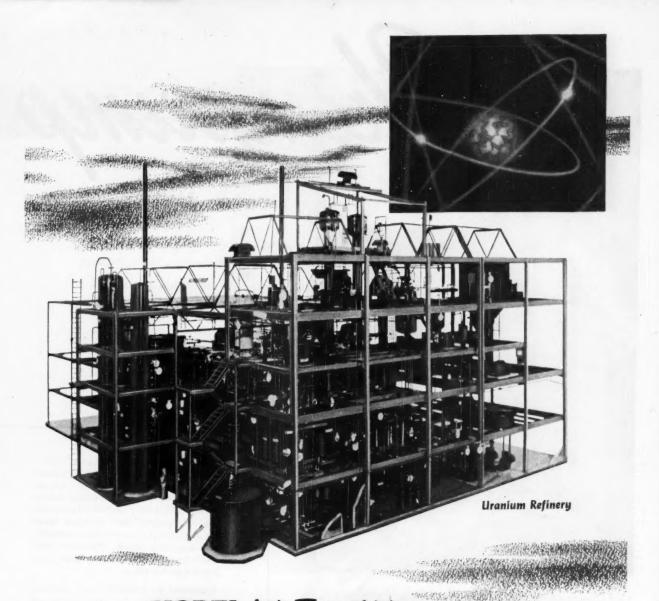
bearing against contamination from dirt and moisture.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

Look for the extra bolts on the end housing... the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to show you a cutaway section of this maintenance-cutting design. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B6210.

ALLIS-CHALMERS





MODEL for Tomorrow

The full scale commercial uranium refining plant—of which this is a model—is now under construction at Port Hope, Ontario, and will be completed in 1955, the first of its kind in Canada. With engineering and construction by Catalytic, it will make available to Eldorado Mining and Refining, Limited (a Crown Company)

the most advanced processes for uranium refining. This new example of our services in advancing uranium technology portrays Catalytic's position of leadership in the industry of tomorrow. We welcome your inquiries today—that Catalytic's on-time, on-budget services may contribute to your success of tomorrow.

CATALYTIC ON-TIME...ON-BUDGET SERVICES

for the atomic energy, chemical, petrochemical and oil refining industries • Project Analysis • Process Design • Economic Studies • Engineering • Procurement • Construction • Plant Operation



CATALYTIC CONSTRUCTION COMPANY 1528 Walnut St., Philadelphia 2, Pa. In Canada:

CATALYTIC CONSTRUCTION

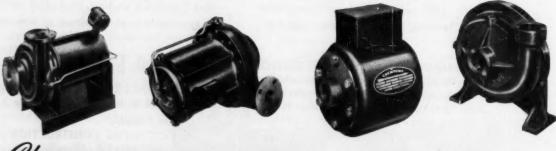


This Chempump, installed at American Viscose Corp., is a ½ hp stainless steel unit which circulates sulfite liquor (magnesium bisulfite containing excess SO₂) through a digester in the sulfite pulping of wood chips. Temperatures range from 100 to 150°C (212 to 302°F). Ambient pressure is approximately 100 psi.

Chempump combines pump and motor in a single hermetic unit. Pumped fluid is allowed to enter rotor chamber of motor; no shaft sealing device is required. Pump impeller and rotor are an integral unit, isolated from stator section by a corrosion-resistant, non-magnetic liner. Pumped fluid cools bearings, rotor and stator, and lubricates bearings.

Approved by Underwriters' Laboratories. Available in wide choice of materials... from 1/8 to 71/2 hp. Capacities to 250 gallons per minute. Heads to 195 feet.

Chempump can't leak!



Chempump — first in the field...process proved

gives superior performance...

at American Viscose Corp.

Only Chempump seal-less pumps provide these cost-saving benefits:

- No seals, no stuffing boxes . . . can't possibly leak . . . ends fluid losses
- No lubrication, no external shaft, no coupling . . . virtually eliminates maintenance
- · No contamination of process fluids
- Handles hazardous liquids with complete safety
- Leak-proof under extreme vacuums or pressures

Here's proof:

At the Pulping Pilot Plant of American Viscose Corp., a leak-proof *Chempump* operates eight hours a day pumping hot sulfite liquor, and is giving very satisfactory service. The pump has been in operation for over a year,

and little or no maintenance is required. The *Chempump* is far superior to ordinary centrifugal pumps with mechanical or hydrostatic seals. Previous experience with these latter pumps was very discouraging.

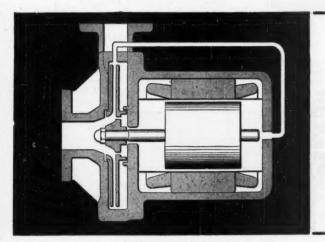
Combining motor and pump in a single unit, Chempump is the most significant advance in pump design in half a century. Normally hard-to-handle fluids—volatile, toxic, corrosive, explosive, "hot," or sensitive—just can't leak or become contaminated. The only maintenance required is a simple bearing change . . . made when required after periodic inspections . . . without special tools . . . with only minimum down-time.

Your process can benefit through Chempump application, too. For more information, send today for new 16-page Bulletin 1010, just off press.

Engineering representatives in over 30 principal cities in the United States and Canada.



CHEMPUMP CORP. . 1300 E. MERMAID LANE . PHILADELPHIA 18, PA.



Please send me details on Chempump for:

(application)

Capacity_____ Total dynamic head_

NI -----

Company____

4.1.1....

City_____Zone____State___

Free!

THIS BRAND NEW BOOKLET ABOUT

automatic speed control



HOW TO APPLY
THE ADVANTAGES
OF VARIABLE SPEED
TO AUTOMATION

Typical applications of Varitrol pneumatic control regulating the speed of Varidrives in response to a signal from such variables as temperature, humidity, pressure, speed, liquid level, weight and tension are dramatically pictured and explained in this full-color booklet. How the Varitrol pneumatic system functions is illustrated with full-color cross-section drawings and diaphanous views of the U.S. Varidrive with exclusive right angle speed-changing linkage. This educational booklet, edited by variable speed engineers, is your guide to a method of greater production of more goods and services at lower cost and astounding man-hour savings. Write today for your complimentary copy.

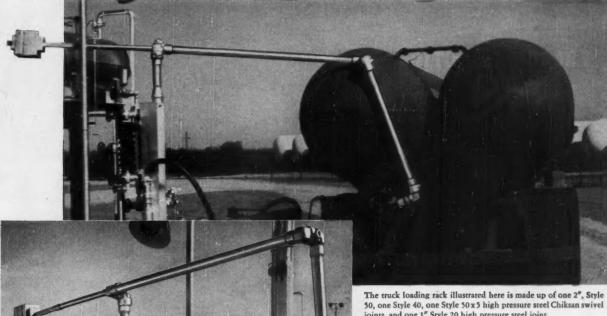
U. S. ELECTRICAL MOTORS, Inc.
Los Angeles 54, Calif. • Milford, Conn.

U.S. VARIDRIVE

WITH VARITROL

REQUEST FOR VARITROL BULLETIN

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Send U.	S. Varidrive Booki	ot no. 1/9/	
Company		THE HOLLEN	



joints, and one 1" Style 20 high pressure steel joint.

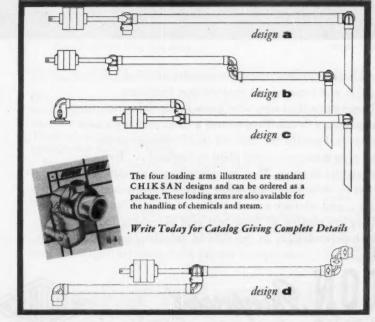
Safety and Speed to Truck or Tank Car Loading of **Gas or Chemicals**

CHIKSAN provides the necessary liquid-tight, gas-tight connections, the characteristic flexibility of motion to keep volatile Butane and Propane or chemicals flowing swiftly with safety, economy and

Loading and unloading lines made up with dependable CHIKSAN ball-bearing swivel joints provide a wide margin of safety by using the same materials used throughout the pipe lines.

Any required degree of flexibility is provided, simply by arranging CHIKSAN ball-bearing swivel joints in proper sequence. Total length of any arm is governed by the required length of pipe sections between swivels. Whether it be a standard design loading arm or a special design for a specific problem, write CHIKSAN today, the nature of your requirements.

> Write to Dept. CE-4 for Catalog giving complete detailed information.

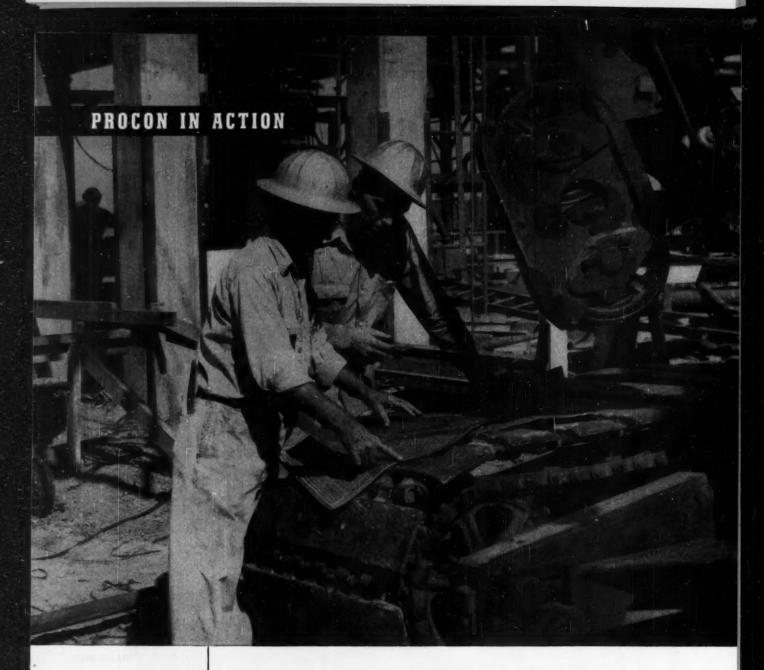


This truck loading rack in an Oklahoma gas company plant is manifolded so it can

either load highly volatile Butane or Propane with complete flexibility and safety.



CHIKSAN COMPANY . BREA, CALIFORNIA . Chicago 3, Illino Well Equipment Mfg. Corp. (Division), Houston 1, Texas . Subsidiaries: Chiksan Export Co., Brea, Calif.; Newark 2, N. J. . Chiksan of Canada Ltd., Edmonton, Alta.



DESIGN
ENGINEERING
PROCUREMENT
CONSTRUCTION

Under the hard hats of Procon's field personnel you'll find some of the most capable and experienced construction engineers in the world. They're practical men who know industrial construction down to the most minute detail. They've had a hand in many major construction projects. Perhaps the last one was a refinery in the Canary Islands... or a petrochemical plant in England... for Procon is international in scope. They're men who are accustomed to responsibilities... who know the value of time and the importance of conserving it... and who are ever conscious of their obligations to the client. They are playing an important part in making Procon synonymous with dependability in the field of industrial construction.

PROCON Incorporated

PROCESS CONSTRUCTION

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U. S. A. AFFILIATED COMPANIES:

PROCON (CANADA) LIMITED—40 ADVANCE ROAD, TORONTO 18, ONTARIO PROCON (GREAT BRITAIN) LIMITED—112 STRAND, LONDON, W. C. 2



Can AMMONIUM THIOCYANATE be used in your process?

available in crystalline form or 50-60% solution

- 1. The Thiocyanate group can be introduced into many organic compounds by reaction of ammonium thiocyanate with the corresponding halide.
- 2. Thiocyanogen can be generated by the electrolysis of an aqueous solution of ammonium thiocyanate.
- 3. Aromatic thiocyanates can be prepared with ammonium thiocyanate with the aid of chloramides. The thiocyano group easily takes up the position para to the amine group, especially when one or both meta positions are vacant. If the position para to the amine group is occupied, the thiocyano group

$$\begin{array}{c}
\text{NH}_{2} \\
2 + 2\text{NH}_{4}\text{SCN} + (\text{NHCl})_{2}\text{CO} \rightarrow \\
\text{aniline} \\
2 + 2\text{NH}_{4}\text{Cl} + (\text{NH}_{2})_{2}\text{CO} \\
\text{SCN}
\end{array}$$

4-thiocyanoaniline
enters one of the ortho positions, but only with
difficulty, with excessive heat liberation, and with
the formation of a thiazole.

4. Some amine salts react with ammonium thiocyanate to give the corresponding amine thiocyanates.

5. Some amine salts yield the corresponding thioureas.

diphenylamine hydrochloride

N,N-diphenylthiourea

- **6.** Guanidine thiocyanate may also be prepared in 90% yield by heating dicyandiamide with ammonium thiocyanate.
- 7. Amidines can be prepared by heating nitriles with ammonium thiocyanate at approximately 180°C.
- **8.** 2-Thiohydantoins can be synthesized from acyl derivatives of a-amino acids with ammonium thiocyanate in acetic anhydride solution.

Baker Ammonium Thiocyanate is a product of synthesis stable at ordinary temperatures.* The crystalline material is soluble, clear, colorless, odorless. These advantages all contribute to economical, more trouble-free manufacturing.

Because Baker controls all of the raw materials that go into Baker Ammonium Thiocyanate, you are always assured of uniform quality, and scheduled availability.

Baker Ammonium Thiocyanate in crystalline form is packaged in 200, 100, and 25-pound fibre drums—all polyethylene-lined. The 50-60% Solution is available in 8000-gallon tank cars. For further information,

address: J. T. Baker Chemical Co., Executive Offices, Phillipsburg, N. J.

*Picks up moisture...should be kept in tightly closed containers.

FREE UPON REQUEST!

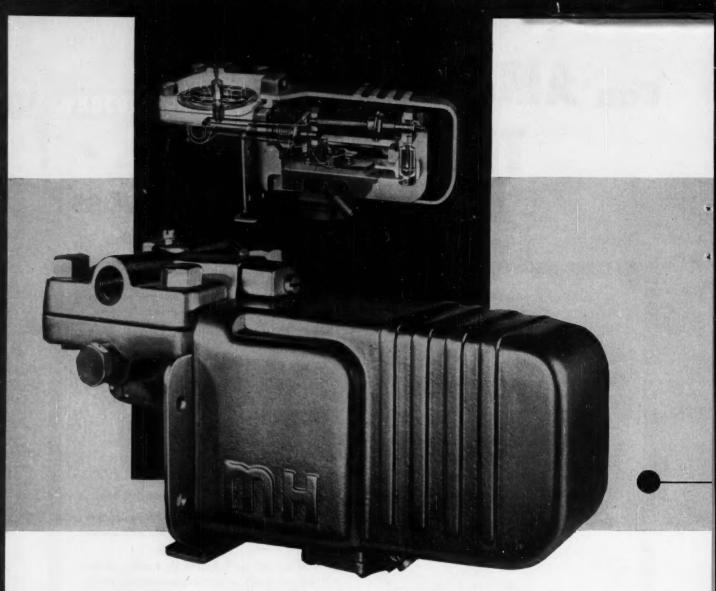
Valuable, new Ammonium Thiocyanate Product Bulletin. This specification manual gives complete data on the properties and uses of Ammonium Thiocyanate, properties of aqueous solutions of Ammonium Thiocyanate, etc. Address your request to J. T. Baker Chemical Co., Phillipsburg, N. J.



Baker Industrial Chemicals

"Purity by the ton"





Every feature your application requires!

CONTINUOUSLY ADJUSTABLE RANGE

Easy field adjustment of range from 0-20 to 0-200 inches of water.

SIMPLE DESIGN

Uses no mercury . . . has few moving parts . . . practically no maintenance.

SIMPLE FIELD CALIBRATION

Check with weights in minutes . . . no curves or tables. 1 lb.=10" water.

LOW AIR CONSUMPTION

Model with pilot relay uses only 0.05 cfm of air.

HIGH SPEED

Practically instantaneous response to changes in flow or level.

HIGH TEMPERATURES

Withstands fluid temperatures up to 350°F... ambient temperatures to 225°F.

RESISTS CORROSION

Teflon diaphragm and stainless steel meter body eliminate usual need for seals or purges.

EASY INSTALLATION

Compact, lightweight unit is easily mounted anywhere.

Plus these new features for liquid level measurements:

LOWER RANGES

Extended down to 0-14 inches of water for liquid level applications.

VERSATILE CALIBRATION

Direct-reading scale, with up to 100% suppression of calibrated range.

Pace-setting performance for flow measurements—now for liquid level, too!

the Honeywell

Differential Converter

The remote transmitter that has set new standards of performance in flow applications—the Honeywell Differential Converter—is now available in a new model for liquid level measurements in closed vessels. Suitable for use with either pressure or vacuum vessels, this model offers all the features of fast response, precision, convenience and ruggedness that have earned the Differential Converter wide acceptance throughout industry. The line now covers practically any flow or liquid level measurement.

This versatile pneumatic transmitter uses no mercury. It can be used in scores of installations where contamination problems have long impeded measurement. Operating on the force-balance principle, it provides exceptional precision and high-speed response . . . makes possible closer control in the most critical applications.

The ideal companion for Honeywell *Tel-O-Set* miniature indicators, recorders and controllers, the Differential Converter can transmit to any of a variety of Honeywell instruments.

Whenever you have a flow or liquid level measuring problem, you'll find the Differential Converter offers you the top in performance and service-ability. Your nearby Honeywell sales engineer will be glad to discuss your requirements in detail. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, Wayne and Windrim Avenues, Philadelphia 44, Penna.

• REFERENCE DATA: Write for Bulletin 2291, "Bifferential Converter Liquid Level Transmitter", and for Bulletin 1160, "Measuring and Controlling Liquid Level."

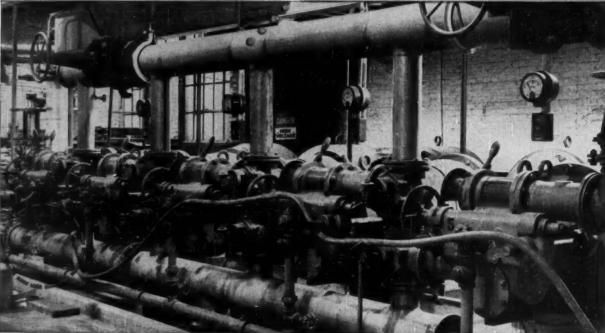


Honeywell

First in Controls

Save Time and Money on Corrosion-Resistant Lines...

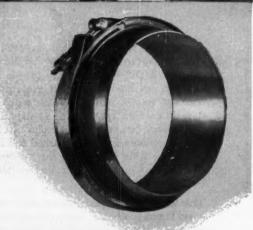




... with TRI-CLOVER Stainless Steel Fittings

Among the most important factors governing the selection of corrosion-resistant fittings and piping are: (1) The assurance of full corrosion-resistance in the actual material; (2) the assurance that the manufacturer has had ample experience and ability in producing a full range of corrosion-resistant material; and (3) assurance that actual costs for installation will be as low as possible, commensuate with the quality of the finished assemblies. When you specify TRI-CLOVER stainless steel fittings, pipe,

When you specify TRI-CLOVER stainless steel fittings, pipe, tubing and pumps you can be sure that all of the above factors have been met... And you can be sure that you are getting full corrosion resistance in every fitting... Thanks to Tri-Clover's specialized experience in solving corrosion-resistant piping problems for chemical-process industries from coast to coast.



STAINLESS STEEL CLAMP-TYPE CONICAL FITTINGS . . . requires only two simple ferrules and clamp to assure leak-tight joints thru the use of Teflon gaskets. Fast, simple assembly and disassembly—Just one of the complete range of Tri-Clover Stainless Steel fitting types to meet practically every corrosion-resistant piping requirement.

See your nearest TRI-CLOVER DISTRIBUTOR EXPORT DEPARTMENT, 8 So. Michigan Ave., Chicago 3, U.S.A.

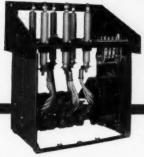
LADISH CO.

Tri-Clover Division

KENOSHA WISCONSIN

These Safety Features

meet operating demands of combustible atmospheres



Oil-immersed main contactor for safe operation

The complete contactor, including magnet and auxiliary switches, operates under oil to prevent sparks from igniting atmosphere and to protect mechanism from corrosion.



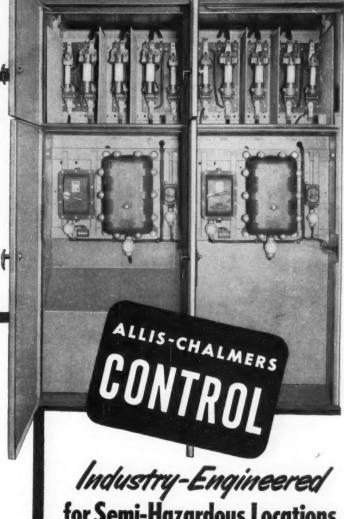
Relays and switching devices in explosion-proof cases

Further protection against the possibility of explosion is provided by NEMA VII enclosure which houses all overload, undervoltage, timing and auxiliary control relays as well as other low voltage switching devices.

Interlocked fuse compartment door

The fuse disconnect door is interlocked. The line contactor must be opened before access to the fuse is possible.

Other features Steel barriers in rear compartment prevent accidental contact with high voltage parts. Enclosure is finished with corrosive-resistant paint. Indoor or outdoor control equipment may be provided.



for Semi-Hazardous Locations

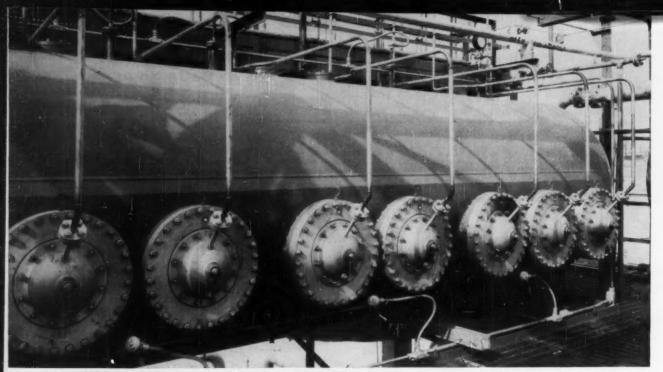
Type H starters for 2300 to 5000-volt motors

For complete information, see your Allis-Chalmers representative or write Allis-Chalmers, Milwaukee 1, Wis.



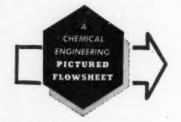
A-4583

IS-CHALM



SALT-OIL REACTOR: key equipment in an important synthetic urea process. Where? Grace Chemical at Memphis, Tenn.

Urea via the Pechiney Process



Proved in a semi-commercial plant in France, the Pechiney Synthetic Urea Process* has just recently been introduced into this country on a large scale.

At Memphis, Tenn., Grace Chemical Co. now turns out 150 tons of Pechiney urea per day-part for fertilizer use, and the remainder for plastics. The plant-designed and constructed by Foster-Wheeler-also includes an ammonia unit which incorporates Texaco partial oxidation and Casale ammonia conversion.

▶ Distinctive Feature—A neutral, mineral oil, circulating through the synthesis system forms the basis for the Pechiney Process. It acts as a "heat sponge," as a medium for recycling unconverted NH₈ and CO₂, and as a corrosion inhibiter.

► How the Process Works—The oil does not enter into the reaction, however. Carbon dioxide and ammonia are the "reacting" raw materials. CO₂ from the monoethanolamine stripper in the ammonia unit, is compressed, preheated. Then it's treated to remove sulfur and oxygen—they can cause severe corrosion problems. Compressed to 3,000 psi. CO₂ is admitted to the autoclave reactor.

Ammonia also enters the autoclave at this point, together with a recycle stream of oil-carbamate slurry.

The synthesis reaction takes place in two stages at 3,000 psi. and 350 F. In the first stage ammonium carbamate (NH₂CONH₄O) forms. In the next, carbamate converts to urea (NH₂CONH₈). In practice about 40% of the carbamate goes to urea; the remainder re-

verts to NH₃ and CO₂ when pressure is released.

The reaction forming carbamate is highly exothermic. Mineral oil absorbs this heat, providing a convenient means of controlling temperature and simplifying the autoclave design. The oil, acting as a coating on the autoclave walls, lengthens the life of the lead-liner.

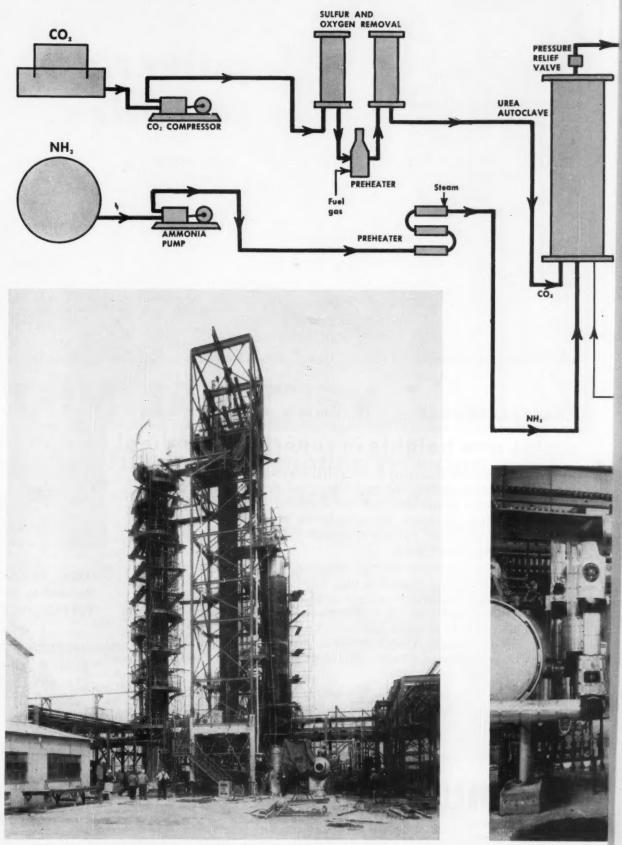
▶ The Salt-Oil Reactor—From the autoclave, the oilurea-carbamate mixture is released to 80 psi. Unconverted carbamate reverts to ammonia and carbon dioxide. These are stripped from the oil, urea and water in a Raschig-ring packed column. Oil is decanted from the urea solution and pumped to the salt-oil reactor.

Unreacted ammonia and CO₃ recombine to carbamate in this salt-oil reactor. Solid carbamate forms on an agitated surface of oil—maintained at a low temperature and 75 to 105 psi.—formed by the action of rotating shafts on which are mounted a number of dispersing disks. Part of the carbamate slurry—a fine matrix of ammonium carbamate in oil—is pumped back to the reactor; part back to the autoclave.

► Making Urea—For fertilizer use, the urea solution goes to a vacuum evaporator, where it's dried to about 0.5% mosture and sent molten at 270 F. to the top of the 200-ft. high prilling tower. Pellets are cooled, dusted with clay and bagged for fertilizer.

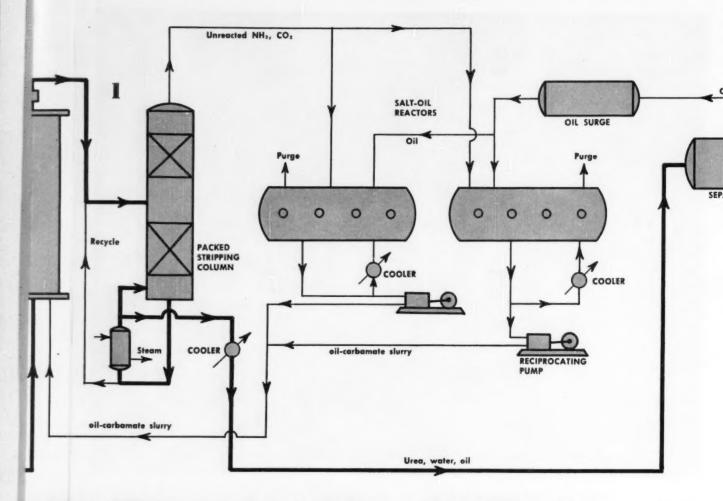
For plastics use, any metal contaminants—which cause discoloration—must be removed. Urea solution flows through a leaf filter together with activated carbon and filter aid. Vacuum crystallization at 80-100 F., centrifugation and drying produce a crystal product.

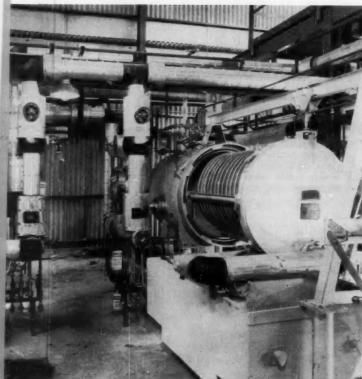
^{*} See Chem. Eng. March 1955, p. 110.



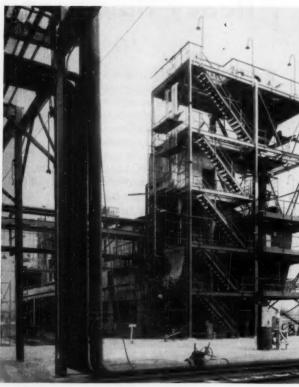
UREA AUTOCLAVE reactor is in the center. At left center is the stripping tower where unreacted ammonia and CO_2 are recovered. The separator is at the right.

2 LEAF FILTERS hand tion is first treated wi

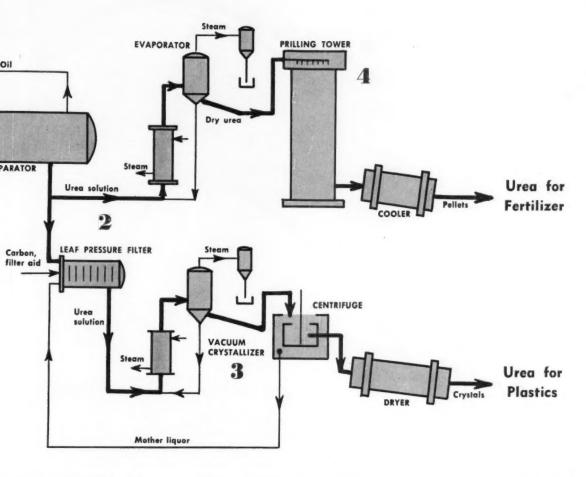




ERS handle a urea solution destined for plastic-grade production. The solutreated with activated carbon and filter aid, before filtration.

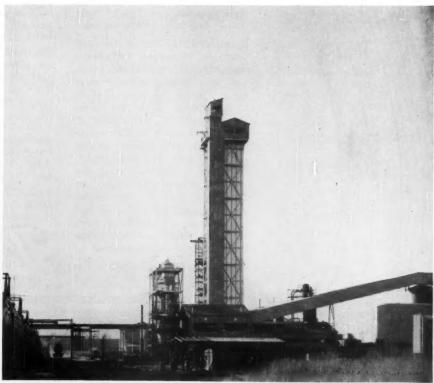


3 VACUUM CRYSTALLIZER for production of plastics-grade the finishing building, containing rotary dryers and blending





urea. In the background is equipment.



4 PRILL TOWER for forming fertilizer-grade urea. Here molten urea droplets fall through an air current. Pellets form; are then cooled and dusted with clay.



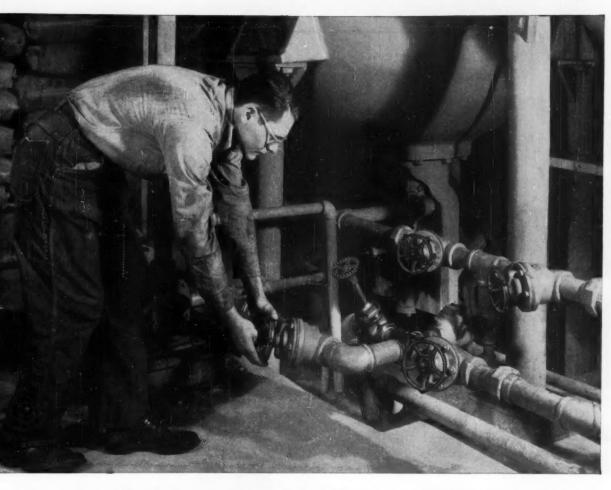
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C



Heavy fluids can't hinder working parts in these CRANE VALVES

HIS CASE HISTORY tells how the United States Playing ard Co., Cincinnati, solved—with Crane Diaphragm Valves—a ostly problem of piping heavy enamels for paper coating.

The trouble was in the plug cocks and conventional gate valves ormerly used in the enamel lines. During normal shutdowns the eavy liquid would build up on seating surfaces, in stem threads and working parts. The cocks and gates would "freeze up"... ere hard to operate... couldn't be shut tight. The condition ampered production... made floors messy and dangerous... ashed maintenance costs sky-high.

Replacing with Crane Packless Diaphragm Valves stopped the ouble completely. Their sealed-to-fluid bonnet and pliable neotene disc insert did the trick. After more than 4 years, all 48 rane valves installed—with no maintenance whatsoever—are ill seating tight...still operating freely and smoothly.

CRANE CO.

General Offices: 836 S. Michigan Ave., Chicago 5, Illinois Branches and Wholesalers Serving All Industrial Areas

CRANE PACKLESS DIAPHRAGM VALVES

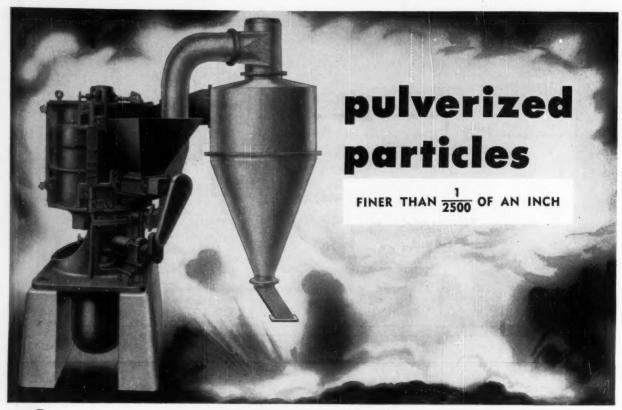
Working parts are safely out of contact with line fluid. The diaphragm seals the bonnet—that's all it does, giving it longer life. The independent disc with pliable insert seats tightly on foreign particles or seat deposits... and controls fluid, even should diaphragm fail. See your Crane Catalog or Crane Representative for wide selection of body, bonnet, and trim materials in these valves for countless uses.





ALVES . FITTINGS . PIPE . KITCHENS . PLUMBING . HEATING

CRANE'S FIRST CENTURY . . . 1855-1955



Raymond VERTICAL MILL_

scales new heights in superfine grinding!

THIS outstanding Raymond development is a specialized grinding unit designed to operate in a fineness range beyond the limits of ordinary pulverizers. It opens up new fields of production in making a wide variety of powdered materials in the lower micron sizes.

Where you have to meet exacting specifications in grinding your products, you will find that this Vertical Mill can give you high grade finished materials at new low cost. The Whizzer classification offers simple and positive fineness control with high product uniformity. Ungrindable impurities are rejected by a throw-out device. The operation is clean, dust-free and automatic.

New uses are continually being found for the Raymond Vertical Mill. Your product may be one which can be handled best on this type of mill—tell us your requirements.

ASK FOR RAYMOND CATALOG #70

SUB-SIEVE SIZES

produced 90-95%

Finer than 10 to

15 Microns

TYPICAL PRODUCTS
handled by the
VERTICAL MILL

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Nevin K. Hiester: Man of the Month

Ion exchange expert is named the outstanding young chemical engineer in the San Francisco Bay Area.

"We've received three nominations; all name the same man— Nevin Hiester." Thus the chairman announced AIChE's Northern California Section's unanimous choice for the title of 1955's outstanding young chemical engineer in the San Francisco Bay Area.

Hiester's selection was one of the highlights of this year's Engineers' Week activities conducted by the engineering societies in the Bay Area. Each society chose the top young (under 40) engineer in its field.

Unanimous pick of his fellow chemical engineers, Nevin Hiester is now manager of the Chemical and Metallurgical Engineering Section of Standford Research Institute, a post he's held since last October. Before that, he was SRI's senior chemical engineer.

▶ War Interrupted Schooling—Only 35, Hiester graduated from the University of Washington in 1941 with a B.S. in chemical engineering. Immediately, he entered the service and spent the next few years as an air liaison officer stationed in San Francisco. In 1945, Major Hiester was ordered to Naples as the Air Corps redeployment officer. A short time later, VJ day arrived, and he found himself happily out of a job.

After discharge, Nevin re-entered the University of Washington and received his masters. He then spent two years at the University of California and, in 1949, got his Ph. D. in chemical engineering. After this, he joined Stanford Research Institute.

►No Specialist—At SRI, Nevin is pretty much of a Jack-of-all-trades chemical engineer. Probably because of his wartime experience in meeting and dealing with people and coordinating and expediting the activities of many different units, the Institute frequently assigns him as project leader on those projects requiring close work with its clients. Thus Hiester's work has been more diversified than it might have been.

For example, he has worked on or led projects involving air pollution, food processing, industrial hygiene, fluid flow and heat transfer, jet and rocket fuels, high temperature operations, an economic survey of the petrochemical industry and ion exchange.

► Ion Exchange Expert—Though
Nevin is no specialist, probably his
most significant work has been on
ion exchange. It was the subject
of his doctoral thesis, and by far
his biggest project to date at SRI
involved the development of two
systems of continuous counter-current ion exchange: One a mixersettler set-up; the other a moving
bed operation.

Hiester and his colleagues have also developed a new method of making selective resins, and have applied for a patent on a continuous ion exchange process for refining sugar.

In addition, he's done a great deal of writing in the past few years, mostly on ion exchange. Highlights include a numerical evaluation of ion exchange equations and a Chemical Engineering feature report (Chem. Eng., Oct. 1954) that has aroused wide-spread interest.

His handbook on a numerical evaluation of ion exchange equations, written with Dow Chemical's physicist, mathematician and

BRAND-NEW FIRE KILLER!



Leave it to Kidde to come up with a red-hot idea like this — a big, new 10-pound dry chemical extinguisher that's effective at *any* pressure from 150 to 250 pounds!

Naturally, this new Kidde 10-pounder has all the special features that make the Kidde Dry Chemical line second to none — fast action, easy handling, simple trigger operation, and extra-wide coverage that snuffs out fire in seconds. But the "wide operating range" feature is what makes the 10-pounder a real standout!

Unlike other extinguishers, which usually operate at one pressure only, the Kidde 10-pounder works through an extremely wide pressure range. Even when charged as low as 150 pounds, the Kidde 10-pounder is UL-approved for Class B and C fires. Boost the charge to 250 pounds, and you have a fire extinguisher with an extra hard-hitting punch!

For fighting fires in deep-burning liquids, electrical machinery and other hard-to-get-at places, *nothing* beats a Kidde Dry Chemical Extinguisher. Good for fires in textiles, too! See to it that *you* have Kidde protection. Call Kidde today!





Walter Kidde & Company, Inc. 428 Main Street, Belleville 9, N. J.

Walter Kidde & Company of Canada, Ltd., Montreal-Toronto

The words 'Kidde', 'Lux', 'Lux-O-Matic', 'Fyre-Freez' and the Kidde seal are trademarks of Walter Kidde & Company, Inc.

NAMES . . .

computer expert, Ascher Opler, has turned out to be somewhat of a "best seller." Published by SRI, it solves long-known equations previously regarded as too complicated for every-day use.

In conjunction with Ted Vermeulen of the University of California and Russ Phillips, an SRI coworker, Nevin is now at work on text book on ion exchange to be published by McGraw-Hill.

Keeps Plenty Busy—Nevin's wife, Audrey, complains that she sees all too little of her spouse between his work, his writing, his extra-curricular activities (he's on the executive committee and is also treasurer of the local AIChE section, as well as a frequent speaker before local service groups) and his post as lecturer in chemical engineering at Stanford University.

On top of all this, he manages to take part in the Research Society of America, the American Rocket Society, the ACS and several other organizations.

Still, Nevin finds time to hone an already acute poker game, keep young in limb through folk dancing and enjoy his newly acquired cabin high in the Sierras. Another favorite retreat is his extensive collection of fiction. Long an addict, Nevin says, "Science fiction keeps you from getting stogy in your thinking."

The Hiesters, their three children and Beau, the family's English springer spaniel, reside in Menlo Park, Calif. Though he married a native California, and has lived in the state almost long enough to be called "native" by California standards, Nevin can't very well fool anyone. There's still a goodly trace of his Hoosier background (he was born in Fort Wayne) noticeable in his speech.—ES

Kenneth R. Brown—Awarded the 1955 honor award of the Commercial Chemical Development Assn. Mr. Brown, vice president of Atlas Powder Co., received the award for his pioneering work in the development and marketing of sorbitol and related products.



Robert E. Hulse

Dr. Hulse, vice president in charge of chemical operations for National Distillers Products Corp., has been elected to the company's board of directors. He has been a vice president of National Distillers since July 1952, and has served as executive vice president and director of National Petro-Chemicals Corp., 60%-owned subsidiary managed by National Distillers, since its inception in 1951. Dr. Hulse also is in charge of National's other chemical activities, including production of metallic sodium and chlorine, anhydrous ammonia, nitric acid and ammonium solutions and the new polyethylene plant nearing completion at Tuscola, Ill.

- Ralph S. Waltz-Vice president and manager, agricultural department, Wilson & Geo. Meyer & Co., San Francisco, Calif.
- M. W. Reynolds—General manager of Acheson Colloids Co., a division of Acheson Industries, Inc. P. C. Buck is head of engineering and production for the parent company.
- Harold Cavin—Consulting engineer for The Alaska Lumber & Pulp Co. Mr. Cavin was engineer for the recently-completed Ketchikan Pulp Co. plant in Alaska.
- H. C. Little—Assistant general manager of American Cyanamid Co.'s agricultural chemicals division.
 F. W. Zipf is manager of manufacturing of the company's in-



ALL OVER THE WORLD

in the Plants of One Company

The pictures shown here are of Abbé Dispersall Mixer installations in a few of the foreign plants of a world-famous manufacturer of cosmetics. There are many more. These mixers are used in the manufacture of tooth and other pastes.

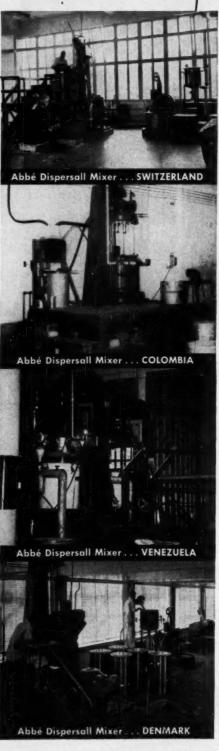
The fact that this company has adopted Abbé Dispersall Mixers for pastes in its foreign plants (as well as in its domestic factories) is ample evidence of the superior performance of these mixers.

About These
ABBÉ
DISPERSALL
MIXERS:

"They have met our requirements for a versatile piece of equipment suitable for relatively small scale production. They have the valuable quality of being easy to clean, which, as you can appreciate, is a decided advantage when more than one product is made in the same machine."

If You Are Mixing Liquids or Pastes...

ask us for a recommendation, as well as full details on the advantages of the Abbé Dispersall Mixer.



ABBÉ ENGINEERING COMPANY 50 Church Street • New York 7, N. Y. NAMES . . .

dustrial chemicals division, H. P. Callahan is techincal director of the manufacturing organization.

Robert C. Bennett-Manager of Atlas Powder Co.'s new food emulsifiers plant at Memphis, Tenn.'



John H. Hilldring

Mr. Hilldring, senior vice president of General Aniline & Film Corp. since 1953, is now president of the corporation, succeeding Jack Frye, recently resigned. Mr. Hilldring served with the U. S. Army for thirty years, retiring in 1946 with the rank of major general. Among the positions he held during and after World War II were assistant chief of staff G-1, war department; member of the U. S. delegation to the Potsdam conference of three powers; alternate delegate to the Far Eastern Commission.

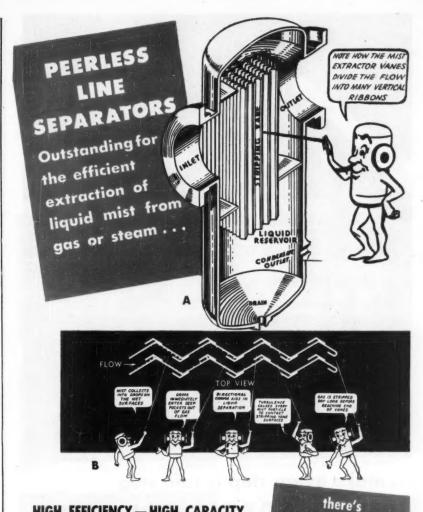
Herman E. Bakken-General manager of Aluminum Co. of America's refining division.

John Polomski—Chief engineer of the products development laboratory of Borg-Warner Corp., in Detroit, Mich.

- I. Bergsteinsson—Senior market research and development engineer for Brea Chemicals, Inc., subsidiary of the Union Oil Co. of Calif.
- A. P. Frame-Elected to the board of directors of Cities Service Co., succeeding Herbert R. Straight, resigned. Mr. Frame is president and a director of Cities Service Research and Development Co.,

vice president and director of Cities Service Refining Corp. and Cit-Con Oil Corp.

- John J. Levenson, Jr.-Appointed senior associate of Cresap, Mc-Cormick and Paget, management consultants with offices in New York and Chicago. Mr. Levenson was formerly technical advisor to the chairman of the board of Reichhold Chemicals,
- Loren P. Scoville-General manager of Diamond Alkali Co.'s chlorinated products division, succeeding C. E. Lyon who will retire May 1. C. C. Brumbaugh replaces Mr. Scoville as director of engineering.
- B. J. Milleville-Chief engineer at Edward Valves, Inc., East Chicago, Ind., a subsidiary of Rockwell Mfg. Co.
- Thomas G. Batchelor-Appointed to the newly-created position of managing director, Hercules Powder Co. (Canada) Ltd.
- Bion D. Barger, Jr.-Joined, along with John Kehm, the process study group of Hooker Electrochemical Co., Niagara Falls. N. Y.
- E. W. Volkmann-Manager, research department, Koppers Co., Inc. E. B. Gunyou has joined Koppers to assist in the company's exploring activities in the nuclear energy field.
- Bruce S. Old-Resumes his fulltime activities as a vice president of Arthur D. Little, Inc., Cambridge, Mass.
- Douglas S. Calder-Vice president and general manager, Mallinckrodt Chemical Works Ltd., Montreal, Can.
- J. B. Macauley-Deputy assistant secretary of defense (research and development). Mr. Macauley, director of technical coordination for Ethyl Corp., will be on



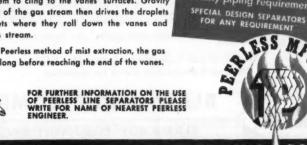
HIGH EFFICIENCY - HIGH CAPACITY LOW PRESSURE DROP

Thousands of installations throughout the Refining and Chemical industry have proven the Peerless Line Separator principle to be one of the most outstanding methods available for the extraction of liquid from gas, steam or air.

Drawing A above shows the arrangement of the vanes in the Separator. Drawing B is an illustration of the Peerless principle.

The mist extractor combines the forces of impingement, centrifugal motion and surface tension to obtain its high efficiency. The path of the gas, etc., through the unit is constantly bending, causing semi-violent turbulence and rolling of the gas against the walls of the vane. Impingement and centrifugal force combine to contact the droplets with the vanes, where they coalesce, and surface tension then causes them to cling to the vanes' surfaces. Gravity and the impact of the gas stream then drives the droplets into the pockets where they roll down the vanes and out of the gas stream.

Through the Peerless method of mist extraction, the gas is stripped dry long before reaching the end of the vanes.



MANUFACTURING

BOX 13165 * DALLAS 20, TEXAS * Dixon 8431 REPRESENTATIVES IN ALL PRINCIPAL CITIES

A PEERLESS

SEPARATOR FOR

EVERY REQUIREMENT

For any capacity For any working pressure

For corrosive conditions

With extra body length

With removable vane units

With connections for accessory equipment

For pressure drop require-

For any vapor-liquid ratio

For any piping requirement

ments of less than 6"



... make every step a safe step BLAW-KNOX ELECTROFORGED® STEEL GRATING and STAIR TREADS

On stair treads, walkways, catwalks, platforms and floors—both indoors and outdoors—you can provide safe walking conditions. For Blaw-Knox Electroforged Steel Grating brings you these exclusive features:



- 1. rigid one-piece construction—easy to install
- 2. non-slip twisted crossbar-for safe footing
- 3. three types of bearing bars
 - · square bars-for smoothest walking surface
 - knurled bars (Furro-Grip)—for extra safety plus relatively smooth walking surface
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NAMES . . .

leave of absence from Ethyl during his year of tenure with the government.

William L. Walsh—Manager of manufacturing in charge of all production operations at all of General Aniline & Film Corp.'s dyestuff and chemical plants. Joseph W. Lang is director of research of the corporation's dyestuff and chemical division.



T. T. Collins, Jr.

Mr. Collins is the new technical director of Hudson Pulp & Paper Corp., with headquarters at the Palatka, Fla. mill. Formerly with Thilmany Pulp & Paper Co. as chemical engineer and for the last two years technical director of National Container Corp., he has been engaged in many branches of pulp and paper mill research and converting development. Among his most widely-known projects for the kraft industry are the development of a black liquor oxidation process and the Venturi-Scrubber.

Milton S. Beringer—President of British American Oil Co. Ltd., succeeding Ole Berg, Jr., recently resigned.

Edward T. McNally—Elected president of the McNally Pittsburg Mfg. Corp., Pittsburg, Kan., succeeding his father, Thomas McNally, recently resigned.

Philip G. Colin—Resumed his regular activities as director of Merck & Co., Inc. pilot plant at Rahway, N. J. David K. Tomer-Administrative assistant to the president of Blaw-Knox Co., Pittsburgh, Pa.



Harold R. Suter

Mr. Suter has been appointed vice president in charge of research and development for the Catalytic Combustion Corp., Detroit, Mich. In his new position, he will be responsible for new and special product applications and will be available for customer consultation in the new fields of air pollution control being served by Catalytic Combustion systems.

Edward C. McCarthy-Plant manager of Monsanto Chemical Co.'s Mound laboratory, operated by Monsanto for the AEC. Henry Groppe has been appointed assistant director of research and development of Monsanto's plastics division.

H. E. Treichler-General consultant for the Pan American Sulphur Co. Mr. Treichler is a veteran in the development of Texas sulfur resources.

Stanley W. Ensminger-European manager of production for the Pfizer Corp., overseas affiliate of Chas. Pfizer & Co., Inc.

James Adams, Jr.-Chief engineer, research and product design, Manhattan Rubber Division of Raybestos-Manhattan, Inc.

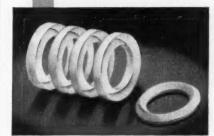
Richard F. Warren-Promoted from senior market analyst to manager of sales service and sta-

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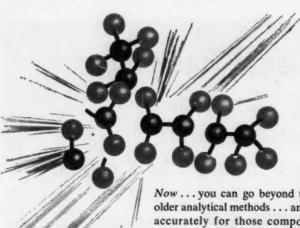
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NAMES . . .

tistics, industrial chemicals division, American Cyanamid Co. Mr. Warren was formerly market editor of Chemical Engineering.



Joseph Hyman

Mr. Hyman has been elected vice president and technical director of the Catalin Corp. of America. In his new position, he will be in charge of research and development, quality control and technical service for the company's plants in Fords, N. J.; Calumet City, Ill.; Thomasville, N. C.

J. B. Willis-Chief process engineer of Sinclair Chemicals, Inc.

Max Potash—Manager of Stahl Finish Co.'s newly-formed polyvinyl chemicals div. Mr. Potash was formerly chief engineer of the American Polymer Co.

B. J. Duffy—Assistant superintendent in charge of all design, economics and other chemical engineering work for the Sugar Creek, Mo. laboratory of Standard Oil Co. (Ind.).

Cedomir M. Sliepcevich—Named chairman of the school of chemical engineering at the University of Oklahoma, Norman, Okla. R. L. Huntington, recently appointed research professor of chemical engineering, will be relieved of administrative duties so that he can devote more time to research.

Carl M. Cooper-On leave from the chemical engineering department at Michigan State College, to serve as technical director of Vulcan Mfg. Division, Vulcan Copper and Supply Co., Cincinnati, Ohio.

- K. C. Vaughan—Manager of the natural gas and gasoline department at Union Oil Co. of Calif., Los Angeles, Calif. W. O. Butler replaces Mr. Vaughan as manager of field operations in the Pacific Coast division.
- H. W. Crogan—Vice president in charge of the Maltbie Laboratories Division, Wallace & Tiernan Inc. E. H. Bluman is vice president in charge of the company's Harchem Division.
- John S. Tunnell-Head of product finishing for The Wayne Pump Co., Salisbury, Md.
- Walther H. Feldman Executive vice president of Worthington Corp., Harrison, N. J.
- Earl F. Boyle—Elected vice president, general manager and member of the board of directors of Van Cleef Bros., Inc., whollyowned subsidiary of Johns-Manville Corp.
- Frank B. Varga—Manager of the project department of Koppers Co.'s chemical division.
- Charles B. Roen—Named an assistant director of Monsanto Chemical Co.'s research and engineering division. Francis E. Reese has been made associate director of engineering for Monsanto's plastics division.
- John R. McMillen-Executive vice president of Monterey Oil Co., Los Angeles, Calif. Mr. McMillen is the former president of Fullerton Oil and Gas Co., Pasadena, Calif.
- R. B. Crean-Elected president of Reflectal Corp., a subsidiary of Borg-Warner Corp.
- William C. Vokolek-Vice president and works manager of the



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NAMES . . .

Franklin Steel Division of Borg-Warner Corp. at Franklin, Pa. M. R. McLary is the new works manager of the company's Ingersoll Products Division, Chicago,

Fred W. Arndt-Chief engineer of Heil Process Equipment Corp., Cleveland, Ohio.

J. D. Hayes, Jr.—Assistant general manager of Hercules Powder Co.'s explosives department. Mr. Hayes succeeds Harry V. Chase, who retired in December of last year.

Kurt C. Frisch—Assistant manager of research for E. F. Houghton & Co., Philadelphia, Pa.

Paul M. Goodloe – Appointed to the newly-created position of director of control for Brown Co., Berlin, N. H.

R. L. Bateman—Director of product development for Carbide and Carbon Chemicals Co. W. A. Woodcock succeeds Dr. Bateman as manager of the fine chemicals division.

Charles F. Bonilla, professor of chemical engineering at Columbia University, John R. Callaham, editor of Chemical Engineering and Richard H. Wilhelm, professor and chairman of the chemical engineering department at Princeton University have been named as members of the Editorial Advisory Committee of the McGraw-Hill Chemical Engineering Series of texts and reference books.

OBITUARIES

E. B. Roberts, manager of the Peoria paper mill and multiwall bag plant at Bemis Bro. Bag Co. until his retirement in 1949, died January 9 following a long illness.

Meyer Goldman, 41, manager of the quality control department, the Visking Corp., plastics division, died January 11, in his home in Terre Haute, Ind. F. Elmer Oswald, president of Pulva Corp., Perth Amboy, N. J., died January 11.

John J. Cadot, executive vice president of Hardinge Co., Inc., died January 19, after undergoing a lung operation. Mr. Cadot was 65 years old.

William K. Jackson, Jr., 44, manager of the packing services division of Union Bag & Paper Corp., died suddenly on January 25.

Richard H. Shainwald, director of Paraffine Cos., Inc. (Pabco) and The California Ink Co., died January 29 at his home in Woodside, Calif.

Alan A. Wood, 63, president and treasurer of Alan A. Wood, Inc., died suddenly on January 29 at his home in Philadelphia, Pa. Mr. Wood was associated with B-I-F Industries, Inc., for 42 years.

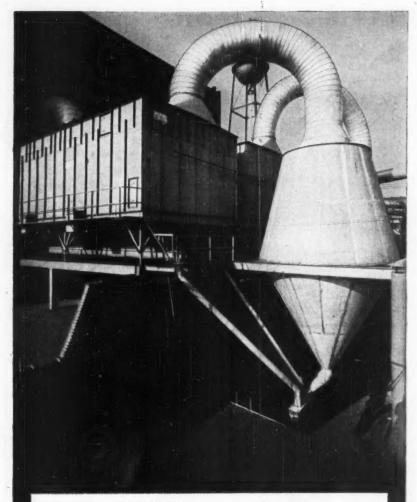
William R. Ellis, 68, retired vice president and director of Hercules Powder Co., died January 30 at Stanford Hospital, San Francisco, Calif., after several months' illness.

Milton A. Lesser, 47, technical editor of Drug & Cosmetic Industry, died January 31 at his home in Brooklyn, N. Y. after a long illness.

Martin Michel, founder of M. Michel and Co., Inc., died January 31. Mr. Michel was 64 years old.

Allan P. Colburn, 50, provost of the University of Delaware since 1950, died February 6 in Baltimore, Md. Dr. Colburn was former research chemical engineer at the du Pont experimental station in Wilmington, Del.

Henry Hardenbergh, 72, chairman of the board of directors of The New Jersey Zinc Co., died February 9 at New Rochelle Hospital, N. Y.





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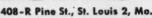
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THIS MONTH'S

Technical

Petroleum Industry

FOREIGN OIL AND THE FREE WORLD. By Leonard M. Fanning. Mc-Graw-Hill Book Co., New York. 400 pages. \$6.

Reviewed by H. C. Parmelee

Development of foreign oil resources by American petroleum companies has not only supplemented declining yields in the United States, but it has had a profound effect on the economies of underdeveloped countries all over the world—that is, the Free World countries remaining outside the Iron Curtain.

These foreign operations by American companies have raised standards of living, supported education, spread sanitation, built hospitals, improved transportation, civilized the jungle, laid out towns and villages, administered law and order, trained native personnel, and contributed as much to the treasuries of Free World governments as to company coffers. But of even greater importance, these policies, dictated by enlightened self-interest, have proved an effective barrier against the spread of Communism in countries that otherwise might fall victims to Moscow's agents. They have also practically

Recent Books Received

Agricultural Process Engineering. By S. M. Henderson & R. D. Perry. Wiley. \$8.50.

Catalysis. Vol. 2. By P. H. Emmett, Reinhold. \$12.

The Chemistry of Portland Cement. 2nd ed. By R. H. Bogue. Reinhold. \$16.50.

Elektrolytische Abscheidung und Elektrokristallisation. By H. Fischer. Springer-Verlag.

Fifty-Five Colorful Years. By E. T. Trigg. Pequot. \$5.

Industrial Detergency. By W. W. Niven, Jr. Reinhold. \$8.75.

Inorganic Chemistry (Ephraim's). By P. C. L. Thorne & E. R. Roberts. Interscience. \$6.25.

Outlines of Enzyme Chemistry. By J. B. Neilands & P. K. Stumpf. Wiley. \$6.50. L. B. Pope

insured the military security of the Free World.

Such, in brief, is the thesis of this volume, which illuminates the record of American companies operating in Free World countries. The author shows an intimate familiarity with his subject, documenting his statements in great detail. His knowledge, furthermore, is firsthand.

One gets a clear picture of the tremendous cost of foreign oil development; of the time lag in realizing profits from investments; of the risks, political as well as financial; and of the business diplomacy required in dealing with people whose culture, law, and religion must be understood if amicable relations are to be maintained.

But the need for wisdom lies not only with the oil companies, but also with the foreign governments. If the latter are too greedy and try to change the ground rules after production has begun, disaster overtakes the country as well as the companies. On the contrary, a cooperative and reasonable attitude by the government fosters relations that benefit both the government and the companies. Mexico, with its folly of expropriation, is an example of the former; Venezuela, with its "50-50" policy of sharing profits typifies the latter. This policy has spread to other oil-producing countries and bids fair to become universal.

The risks of developing foreign oil are such that several companies usually engage jointly in the enterprise, sharing costs and profits. This has given rise to the charge, vigorously denied and unproved, that American and foreign oil companies are united in a cartel that kills competition. It seems unlikely that the United States can sustain a suit under the antitrust lawsparticularly when it gave its blessing to a cooperative arrangement among American companies in reopening the Iranian oil fields. Incidentally, the chapter devoted to





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ROOKSHELF . . .

the story of settling the dispute between Iran and the Anglo-Iranian Oil Co. is a tribute to American diplomacy exemplified in the person of Herbert Hoover, Ir.

The desirability, indeed the necessity for an international oil policy is set forth in a chapter that reviews the situation and poses a dozen questions that need consideration in drafting a policy. An appendix is devoted to the statistics of the oil industry, and another to general matters pertaining to the international aspects of the oil business.

Expanded Principles

CHEMICAL PROCESS PRINCIPLES. Part I. Material and Energy Balances. By O. A. Hougen, K. M. Watson and R. A. Ragatz. 2nd. Ed. John Wiley & Sons, Inc. New York. 504 pages. \$8.50.

As a lower junior I hurried to the college bookstore and proudly bought a copy of Hougen & Watson, Part I, as a text for my first honest-to-goodness course in chemical engineering. The student price was about four dollars.

The course was rough. The prof was worse. He had flunked 60% of his class the year before in order to hold down the number of juniors so that it matched the number of benches in the chemical engineering laboratories.

Most of the students thought that Hougen & Watson was a difficult book. I still think it was the

prof.

Now there's a second edition of this time-honored text. It's bigger (504 pages), costs more (\$8.50) and there's a third man on the team (Ragatz). There have been some changes made and some excellent additions.

A new chapter on mathematical procedures, and conversion of units and dimensionless groups has been added. These student stumbling blocks are cleared away right at the start with a "how-to" approach on trial-and-error methods, graphical integration, graphical differentia-

tion and the use of engineering graph papers.

New correlations of physical constants are given and explained in up-to-date terms. This edition includes new information on:

- Material balances in stagewise extraction.
- Equilibria in ternary systems.
- Material balances in stepwise countercurrent processing.
- Thermochemistry of nuclear reactions.

Generalized procedures are given for estimating physical properties of compounds when you lack experimental data. Methods are presented for dealing with the effect of recycling, bypassing, changes in inventory and accumulation of inerts.

40% of the problems are new. Answers are given for many of the odd-numbered ones. (In the first edition there were no answers given at all.)

And if for no other reason here's why every chemical engineer should have a copy of this edition available to him. To solve arguments.

How many times have you found that your definitions of the terms used in chemical processing didn't agree with those used by fellows graduated from other schools. Quick now, let's hear your definition of conversion, yield, ultimate yield, over-all yield and space-time yield.

Simple definitions of these and other useful terms can be found in Table 14 on page 215. We recommend that you get hold of it.—RFF

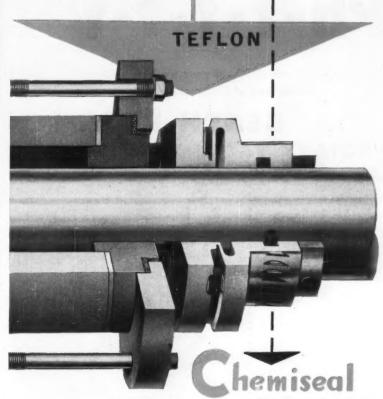
Introduction

THE ELEMENTS OF CHROMATOGRAPHY. By T. I. Williams. Philosophical Library, New York, 90 pages, \$3.75.

Reviewed by C. M. Martini

All who are unfamiliar with the scope and possibilities of the various phases of chromatography will find this book helpful as a brief, elementary introduction to the field. The book describes the methods of adsorption, partition, ion-

point of interest to pump users...



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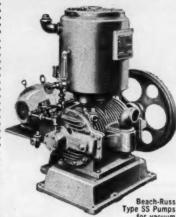
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BOOKSHELF . . .

exchange chromatography, as well as other more specialized kinds of chromatography. The text also supplies many references to review articles in each of the fields for those desiring a more extensive treatment of a particular phase of the subject.

Salt-Formers

COMPREHENSIVE INORGANIC CHEMISTRY, Vol. III, The Halogens. By Robert C. Brasted. D. Van Nostrand Co., New York. 250 pages. \$5.

Reviewed by K. A. Kobe

Volume III of this rapidly growing set of Comprehensive Inorganic Chemistry presents only one group of elements whose industrial importance is paramount—the halogens. A four page introduction compares the five (yes, five) elements, particularly as to electron structure and oxidation states. Each element is then given a separate chapter on occurrence, preparation, physical properties, chemical properties, and uses. The fifth halogen-Astatine (symbol, At)-gets five pages on its preparation by nuclear disintegration and its physical and chemical properties, concerning which there is a surprising amount of information.

In all cases the information given concerning industrial preparation is quite complete. For fluorine and chlorine there are illustrations of commercial equipment. For chlorine, the Hooker S, Nelson, Vorce, Castner-Kellner, de Nora, and Mathieson mercury cells are shown diagrammatically. Incidentally, other illustrations are absent except for two curves showing boiling and melting points. This has been a common characteristic of the set so far, and it would seem that more figures could be used advantageously without increasing the cost.

The hydrohalides are discussed individually in a single brief chapter: preparation, physical and chemical properties. Hydrogen fluoride's unique properties as a solvent are presented quite fully. The chapter on oxycompounds of the halogens

is more extensive, for here are found the chlorine oxides, the hypochlorites, chlorites, chlorates and perchlorates. Commercial methods of

preparation are given.

The more unusual chemistry of the halogens is found in Chapter 8 on the positive halogens, interhalogens, and polyhalide anionic complexes. Although not mentioned, the Hanus and Wijs methods for iodine number of unsaturated oils is the closest contact that many chemists have with the interhalogens. Such compounds as I(py): NOa, IPO4, BrFa, (NO2) PFa, IFa, IF, KIBr, leave one surprised at the diversity of compounds that occur among such a close family. The concluding chapter treats the halogenoids and related compounds, as cyanogen and the like.

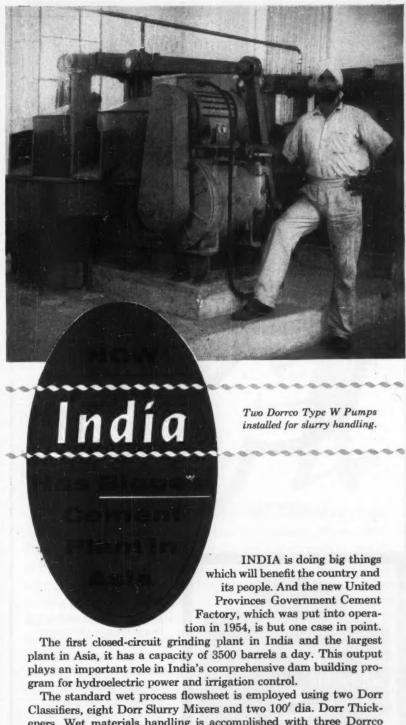
This volume has been more quantitative in its treatment of the halogens than was the previous volume with group Ib. The treatment is reminiscent of Yost and Russell, though thermodynamic properties are not stressed as greatly. Many recent references to the literature and patents are given. One would desire more illustrations. Because of the importance of the halogens and the up-to-date treatment given, this individual volume in the set should have wide acceptance.

Organic Adjunct

COLORIMETRIC METHODS OF ANALYSIS. Third edition. Vol. IV. By Foster Dee Snell and Cornelia T. Snell. D. Van Nostrand Co., New York. 676 pages. \$12.50.

Reviewed by R. S. Browning, Jr.

This new edition has increased the number of pages devoted to organic material by some fifty percent, accounting for the appearance of this fourth volume, which contains material impossible to include in the third. The compounds covered are classed in loosely associated groups, as previously. Sections on sterols, hormones, nitrogen compounds, alkaloids, hemoglobin and related compounds, enzymes, proteins, and compounds with in-

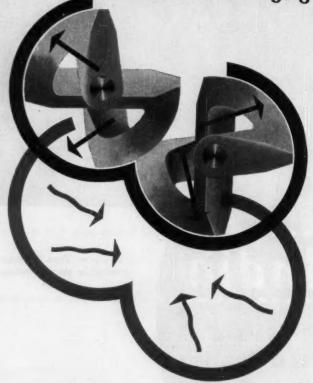


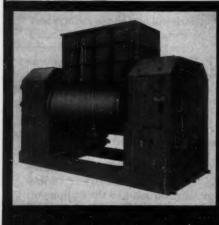
eners. Wet materials handling is accomplished with three Dorrco Type W pumps and twelve A. C. Wilfley & Son pumps of various sizes. Dorr-Oliver, Ltd. of London supplied most of the equipment.

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BOOKSHELF . . .

organic radicals have been enlarged and brought up to date. New chapters have been created for antibiotics and natural pigments.

The authors say they aimed at completeness. This extensive coverage has created an immensely valuable adjunct to the analytical laboratory. In addition, the numerous references and adequate discussions of the merits of the methods presented make the book a useful source for anyone seeking practical information.

Sound & Basic

Physical Properties of Solid Meterials. By C. Zwikker. Interscience Publishers, New York. 300 pages. \$8.75.

Reviewed by C. L. Mantell

This book is intended to meet the need for a concise summary of the entire field of solid state physics. The emphasis is on the theory and empirical side. Each phase of the subject is discussed up to the point of practical application. These, however, are but hinted at and not described in an engineering sense.

Starting with the elementary particles and forces from the view-point of the periodic system of the elements, the properties are discussed from the viewpoint of atomic structure. There follows a chapter on constitution and properties such as hardness related to these.

Succeeding chapters deal with heterogeneity in materials as diverse as metals, stones, minerals, pigments; anistropy and its effects, particularly related to thermal expansion, conductivity, and piezoelectricity. Systematic relations, pure theoretical effects, mostly those reciprocal in nature, are then discussed, followed by the property of elasticity, its theoretical background, its relationship to sound, optics, and basic properties. The elastic after-effects, dielectric losses, viscosity, chemical diffusion, plasticity, are coordinated.

The next section concerns thermal properties and their anisotropy; transformations, allotropes, phase transformations, age hardening. The next section concerns porosity, permeability, ferromagnetism and ferroelectricity, and the electronic properties of conductors, semiconductors, and insulators. The last and concluding section deals with surfaces and surface properties, corrosion, deterioration, adsorption, electron emission, and rectifiers.

The volume is a sound, basic treatment with the emphasis on the theoretical side. Its coordinating effort is unusual, concise and terse. For the engineer, chemist or chemical engineer who desires to bring himself up-to-date on solid state physics, the book is recommended but not for light reading.

Background Material

STARCH AND ITS DERIVATIVES. By J. A. Radley. Third edition revised (2 volumes). Vol. I—524 pages. Vol. II—465 pages. John Wiley & Sons, New York. \$20.

Reviewed by W. L. Faith

This is the third edition (revised) of a two-volume monograph on starch and its derivatives. Vol. I covers the structure of starch and the action of enzymes upon starch. Vol. II covers the manufacture of starch, its industrial applications, and methods of analyses. In each volume, the state of the art is brought up to about 1948 or 1950. Vol. I appears to be authoritative and thorough and is recommended to all chemists and technologists doing research in the field or using starch in its various applications. Some of the most recent work on chemically modified starches is not included. With the exception of dextrins, there is also very little information on the degradation products of starch, e.g., syrups and sugars.

In Vol. II, the technology of starch manufacture is covered in a descriptive manner. The chapter by Kerr on the manufacture of corn starch is exceptionally well done, but again brings the status of the industry only to about 1948. Many of the recent changes in the indus-



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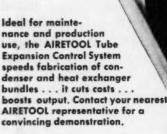


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try are accordingly not included. The same is true of the chapter on the manufacture of dextrose. Information on the manufacture and uses of glucose is extremely sketchy. Very little of the reasoning behind the widespread use of glucose in the fruit-canning industry and dextrose in the baking industry is touched upon. Twenty pages are devoted to the manufacture of dextrin and British gums. This chapter was exceedingly interesting to the reviewer and is one of the best in the two-volume work. There is very little in the so-called secret technology of dextrin, adhesives, and thin-boiling starches that cannot be derived from the basic material in this chapter. In like manner, the applications of starch and its derivatives in the food industry, the paper industry, and the textile industry is well presented.

Because of the 1948-50 cutoff period, there is no information on recently developed products such as the instant puddings and instant laundry sizes. A very short fourpage chapter on the utilization of the byproducts of starch manufacture is incomplete and misleading. The final section on the examination and analysis of starch is sufficiently detailed for the most exacting analyst.

All in all, the two volumes fulfill their purpose of serving as background material for those either doing research in the field or using starch and starch products in manufacturing processes.

Systematics

NUCLEAR SPECIES. By H. E. Huntley. St. Martin's Press, New York. 193 pages. \$4.50.

Reviewed by H. M. Clark

"Nuclear Species" covers the limited region of nuclear physics encompassing such topics as the properties of the nucleus, isotopes, empirical rules relating stable and radioactive nuclides, nuclear binding energy, energy levels, the semi-empirical mass equation, and the origin of the elements. Emphasis is on the systematics of the nuclides

rather than on individual nuclei.

The author gives a brief but lucid account of both the evolution and the current status of our understanding of the properties and systematics of nuclides. Special terms used in describing nuclides are clearly defined and are illustrated with examples in the text. Tables and figures are used liberally. Quantitative aspects are treated precisely. The few well-chosen references given at the end of all but one of the 12 chapters could have been supplemented advantageously.

In the preface, the author expresses the hope that the book "will provide a readable introduction to nuclear physics for students of both physics and chemistry." The book more than meets the author's aims and is recommended as enjoyable and informative reading for all who have an interest in nuclear species.

Organic Peroxides

ORGANIC PEROXIDES. By A. V. Tobolsky and R. B. Mesrobian. Interscience Publishers, New York. 197 pages. \$5.75.

Reviewed by F. K. Kirchener

Here's an execellent and brief introduction to the field of organic peroxides. The author's purpose is to show the role that these interesting compounds play in catalyzing chain reactions such as vinyl polymerization. This they have done in a direct and orderly manner. The book is divided into three main sections.

A short but adequate first section deals with the preparation, properties, and structural classification of organic peroxides. Included in this section are the analytical methods for the determination of the peroxides.

The second section is concerned with the decomposition of peroxides with special attention to ditertiary butyl peroxide, benzoyl peroxide and related peroxides. This section includes the diagnostic tests for the detection of radical decomposition of peroxides.

The third section covers the ini-



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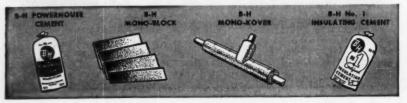
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tiation of vinyl polymerization by peroxide decomposition. This is discussed under the headings of the general nature of vinyl type polymerization, the kinetics of vinyl polymerization, and the rates of initiation in vinyl polymerization.

The book closes with four useful appendixes covering the physical constants of selected organic peroxides, their explosive nature, commercial sources and catalyst efficiency. There are many references to the original literature, numerous tables and well-organized author and subject indexes.

Analysis

INSTRUMENT METHODS OF CHEMICAL ANALYSIS. By Galen W. Ewing. McGraw-Hill Book Co., New York. 434 pages. \$6.50.

New Instrumental Methods in Electrochemistry. By Paul Delahay. Interscience Publishers, New York, 437 pages. \$11,50.

Reviewed by F. C. Nachod

Chemical analysis has moved a long way from the beaker, funnel and buret techniques towards automation. The modern analyst will try to find if possible an instrumental method which admits faster unit operations of analytical tasks. With this in mind, it is not altogether surprising to find two new books dealing with instrumental analysis.

Dr. Ewing's text is primarily a classroom book for an undergraduate course. There are many illustrations and drawings, as well as outlined experiments and problems. Coverage of instrumental techniques is complete and some topics (extraction, chromatography, ion exchange) even are clearly outside of the scope of the title.

Dr. Delahay's text is more specific and clearly limited to electrochemistry. His text is more appealing to researchers and to graduate students specializing in electrochemical analysis. Coverage of the topics is complete and concise, and a contributed chapter on high fre-

quency methods (C. N. Reilley) deserves special mention.

Both books can be recommended to the respective audiences but will be of limited interest to the chemical engineer.

FRP Compilation

FIBERGLAS REINFORCED PLASTICS. By Ralph H. Sonneborn and Others. Reinhold Publishing Corp., New York. 243 pages. \$4.50.

Reviewed by C. L. Mantell

This book was written to fill the need for a compilation of information on Fiberglas reinforced plastics. The first chapter is a general discussion on the nature and uses of Fiberglas reinforced plastics, while the second deals with the properties of Fiberglas, its forms, and the resins employed with FRP. Chapters 3, 4, and 5 are how-todo-it type of information, covering manufacturing processes, molds, preforms, machining, connections, painting, repair, inspection and testing. Chapters 6, 7 and 8 deal with the properties of Fiberglas reinforced plastics, the design methods, and the applications.

The second part of the volume contains two chapters, written by A. G. H. Dietz on the design theory of reinforced plastics, and the structural design of FRP laminates

by Alton S. Heyser.

The book excellently fulfills its purpose and serves as an up-to-date compendium on Fiberglas reinforced plastics in their rapidly growing and multitudinous forms. While to the expert it may be something of a primer, to the uninitiated it is a complete textbook.

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THIS MONTH'S

Recent Books

For Fluoridating

Commercial fluosilicic acid is a strong and corrosive liquid. Water treatment plants will be interested in these new specifications which cover, safety, sampling, inspection, packing, marking and testing. 5 pages.

> "Tentative Standards for Fluosilicic Acid." American Water Works Association, 521 Fifth Ave., New York 17, N. Y. 20¢

Hydrocarbons

Report of investigations to determine and correlate properties of pure hydrocarbons with those of petroleum fractions; aniline point, flash point, pour point and blending viscosities. 96 pages.

> "The Quarterly." Vol. 49, No. 4, Department of Publications, Colorado School of Mines, Golden. \$2.

Electrodes

How carbon and graphite electrodes are made for the chemical and metallurgical industries. 16 pages.

"Engineered Performance." Great Lakes Carbon Corp., 18 East 48 St., New York 17, N. Y. Gratis

Administrative Standards

A concept of a national system of standards will buttress decision-making and clarify the relationships between companies and national standards. 10 pages.

"National Standards in Industrial Administration." By Dickson Reck. Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa. Gratis.

Corrosion Resistance

Behavior of materials of construction in the presence of active

& Pamphlets

chemical agents. This series of reference sheets will cover 100 materials and 1,200 chemicals. 200 sheets are now available from abietic acid through benzilic acid.

"Dachema-Werkstoffe-Tabelle." Edited by E. Rabald and H. Bretschneider. DECHEMA, Frankfurt am Main, Germany. DM 0.30 per sheet.

Adhesives

A collection of 12 papers presented at a conference on metal-to-metal adhesives. Although specially directed at aircraft production, data cover fabrication, design, testing and theoretical aspects of adhesive-bonded metals. 64 pages.

"Metal-to-Metal Adhesives for the Assembly of Aircraft." Edited by R. G. Newhall. Western Business Publications, 274 Brannan St., San Francisco 7, Calif. \$4.

Spectroscopy

Five papers from a seminar dealing with spectrochemical analysis: instrumentation, excitation, interpretation, standard method for stainless steels and direct analysis of cerium in cast iron.

"Transactions of the Southeastern Seminar on Spectroscopy." Bulletin 68, Florida Engineering and Industrial Experiment Station, Gainesville, Fla.

Testing Laboratories

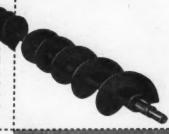
A directory listing locations of testing laboratories equipped and prepared to undertake testing on a commercial or fee basis. Gives the user a good indication of the laboratories most likely to be prepared to undertake the tests desired. 48 pages.

"Directory of Commercial and College Testing Laboratories." American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. \$1.

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THIS MONTH'S

Firms in

New Representatives

Dunton Processes, Inc., New York, has appointed the J. L. Middleton Co., Miami, and O'Brien Specialty Co., Syracuse, as agents.

Speedways Conveyors Co., Inc., Buffalo, has selected the Hamerslag Equipment Co., San Francisco, as distributor.

Cleaver-Brooks Co., Milwaukee, has appointed the Tamco Engineers, firm, San Francisco, as representatives for its boiler equipment.

Fielden Instrument Div. has named the Broger Instrument Sales Co., Inc., Boston, as distributor for its process instruments.

O. W. Kromer Co. has chosen the Seitz Distributing Co., Billings, Montana, to handle its line of power sprayers.

Bourns Laboratories, Riverside, Calif., manufacturer of potentiometer instruments, has named a New York agent—D. R. Bittan Co.

Sealube Co. has appointed the Livingstone Coating Corp. as southeastern distributor for its line of corrosion resistant products.

General Ceramics Corp., Keasbey, N. J., has selected the Cochrane Co. as West Coast representative.

Electric Regulator Corp. has selected Satullo Co., Royal Oak, Mich., and H. P. Woodit & Associates, Jamaica, N. Y., as agents.

Mackay Industrial Equipment Ltd., England, has chosen the Seaboard Equipment Co. as exclusive agent in the U. S. and Canada for its "Merton Overloader."

the News

M. A. Gibbons

Industrial Control Co. has appointed the Wright Eng. Co. as western sales agent for its line of automatic control devices.

Ampco Metal, Inc. has appointed the Hays Supply Co., Memphis, Tenn., as distributor for its line of centrifugal pumps.

New Companies

Chemicals for Petroleum Industry, Inc., Houston, has been organized to produce and market thermine and other specialty chemicals.

Steams-Roger Mfg. Co., Denver, has established a subsidiary at Calgary, Alberta.

Strick Plastics Corp. has been organized upon the completion of a new \$\frac{1}{4}\$ million plant for the manufacture of reinforced fiberglas, in Perkasie, Pa.

Sartorius-Fischer, Göttingen, Germany, is the new affiliate of the Fischer & Porter Co.

Rampe Mfg. Co., manufacturer of custom molding and injection plastics, has incorporated its business.

General Ultrasonics Co., Hartford, Conn., will manufacture and market industrial ultrasonic processing equipment.

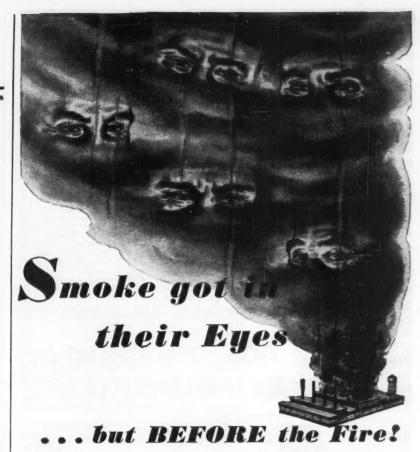
New Names

Esso Research & Engineering Co. is the new corporate name for the Standard Oil Development Co.

Honan-Crane Corp., Lebanon, Ind., will change its name to Houdaille-Hershey of Indiana, Inc.

New Locations

H. Clay Glover Co., Inc., pharmaceutical manufacturer, has re-



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DENVER Steel-Head BALL MILL		3'x 2' to 6'x 12'	A Denver Steel-Head Ball Mill will suit you particular need. Five types of discharge trun nions. All-steel construction. Low initial cast due to quantity production. Quick delivery Laboratory and pilot plant mills also available, Please write for Bulletin No. B2-B13
DENVER CLASSIFERS	1	18" to 60" Wide Suitable Length	Denver Roke Type Classifiers are available in sizes from 1'-6" x 14'-8" to 8' x 21'-8". Denver Spiral Classifiers range in size from 6' x 3'-8" to 60" x 33'-4". Denver Hydra Classifiers are available in diameters from 6' to 55'. All are designed to efficiently separate fine particles in specific applications. Please write for bulletin No. CSC-B.
DENVER Forced-Feed JAW CRUSHER	丁	21/4"x 31/2" to 32"x 40"	Cast Steel Frame, monganese jaw and cheel plates. Large diameter shafts reduce shaft deflection and thus increase life of heavy duty, oversize roller bearings in bumper. Setting easily controlled. Please write for Bulletin No. C12-312.
DENVER Wet Reagent FEEDER	45	0 cc to 2000 cc	Accurately meters minute quantities of liquid from 0 cc to 2000 cc per minute. Float valve in tank permits connection of teeder to bulk storage device. Handwheel adjustment to control amount of liquid is simple and accurate. Used in multiples for higher capacities. Please write for Bulletin No. F6-89.
DENVER Disc FILTER		1 Disc, 2' to 8 Disc, 6'	Special, patented design of segments in Denver Disc Filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive, with no blow-back. Simple, low-cost, dependable construction. Quick delivery. Also Drum and Pan Fillers. Please write for Bulletin No. F9-B2.
DENVER "Sub-A" FLOTATION		Laboratory and Commercial	Flotation is the selective separation of particles from each other in a liquid pulp by means of air bubbles. More large plants are installing Denver "Sub-A's" for their entire flotation job, because they give maximum recovery at a low cost per ton. Dependable, fow-cost, simplified continuous operation. Please write for Bulletin No. F10-B81.
DENVER Wilfley Concentration TABLES	-	5 to 150 T/24 Hrs.	A mechanically operated, longitudinally re- ciprocating table consisting of a deck hav- ing a plane surface partly riffled and a till- ing device. It separates materials into bands and handles the coersest sands with excel- lent results. Ideal for separation of groups of particles having a similar range of spe- cific gravities. Write for Bulletin No. T1-B3.
DENVER LABORATORY EQUIPMENT	3	Batch or Continuous	Batch and continuous test models of Crushers, Screens, Ball Mills, Pulverizers, Rod Mills, Classifiers, Agitators and Mixers, Pulp Dis- tributors, Feeders, Flatation Machines, Punps, Thickeners, Filters, Dryers, Tables, Samplers, Results obtained on Denver Laboratory Equip- ment can be duplicated by commercial ma- chines. Please write for Bulletin No. LG3-B10.
DENVER Standard	M	2'x 15' to 5'x 40' end larger	Available in several types: Direct Heat, In- direct Heat, and Steam Tube. Let DECO En- gineers solve your drying problem. No dryer problem too small or too large. Please write for Bulletin No. D4-82.

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FIRMS . . .

moved its executive offices to the Meadowbrook Nat'l Bank Bldg., West Hempstead, L. I.

Olin-Mathieson Chemical Corp. will move the headquarters of its Puritan Automotive Sales Dept. from Rochester to Baltimore.

American Potash & Chemical Corp. has relocated its New York offices from the Chanin Bldg. to 99 Park Avenue.

New Lines

Foster Grant Co., Leominster, Mass., has entered the field of high-flow and high-impact polystyrenes.

Consolidated Eng. Corp., Pasadena, Calif., will now manufacture control instruments developed by Phillips Petroleum Co.

Hy-R-Speed, Inc., will add Mix-Mor mixers to their present line of Hy-R-Speed mills and batch mixers.

U. S. Steel Corp. has begun commercial production of plastic pipe, in Pittsburgh, geared toward markets in mine drainage and sewage.

New Facilities

Rack Eng. Co., California, has opened its new fabricating and assembly plant in Gardena, Calif., for its material handling equipment.

Shell Chemical Corp. has opened a district sales office in Pasco, Wash., to supervise agricultural ammonia sales.

International Minerals & Chemical Corp., Carlsbad, N. M., plans a \$1 million expansion of its potash division.

General Controls Co. has begun construction on two additional facilities in Glendale, Calif.

Pan American Refining Corp. has opened its new Research Laboratory in Texas City, Tex. Witco Chemical Co., New York, has acquired half interest in Ultra Chemical Works, Inc., Paterson, N. J.

American Machine & Foundry
Co. has leased 27,000 sq. ft. of
space in the Fawcett Bldg.,
Greenwich, Conn., in an expansion move.

Sherwin-Williams Co. has completed its new plant in Vallejo, Mex. Production of paint products has already begun.

Rayette, Inc., plans the construction of a new chemical plant for the manufacture of cosmetic grade chemicals in St. Paul, Minn.

Chemical Enterprises, Inc., has acquired a new affiliate—Chemco of Iowa, agricultural fertilizer concern.

Columbia University has begun construction of its new physics research building, at a cost of \$350,000.

Schering Corp., Bloomfield, N. J., has consolidated all administrative facilities at 60 Orange Street, in that city.

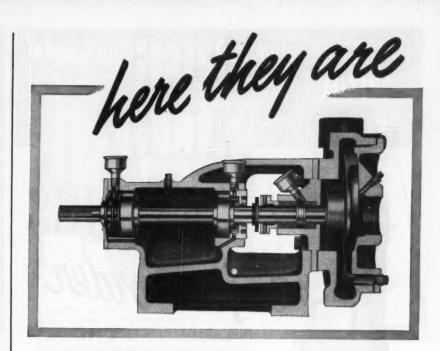
Wolverine Tube, Div. of Calumet & Hecla, Inc., has opened a new mill depot in Minneapolis, Minn.

Sun Oil Co. will soon operate two new Houdriflow units at Toledo, Ohio, and Marcus Hook, Pa. Contractor is Chicago Bridge & Iron Co.

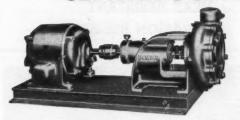
American Smelting & Refining Co., New York, has established a national aluminum dept.—as a part of its Federated Metals Div.

Stauffer Chemical Co., New York, has completed a modern insecticide and fungicide blending plant in Lubbock, Tex.

Foster D. Snell, Inc., has purchased The Crippen and Erlich Laboratories, Inc., Baltimore.



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Duraloy is the BEST place to come for your high alloy casting requirements. We are specialists in turning out castings to order. Simple jobs, tough jobs; large jobs, small jobs. Static cast or centrifugally cast...you name it and we'll produce it.

The melt, the casting and the finishing are all carefully controlled and quality tested by our technicians. Our test equipment, including 400,000 volt X-ray and gamma-ray facilities, is just one way Duraloy assures delivery of Better High Alloy Castings.

Send for Bulletin No. 3354-G.

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DETROIT OFFICE: 23906 Woodward Avenue, Pleasant Ridge, Mich

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FIRMS . . .

Warner-Chilcott Laboratories will construct new research facilities in Morris Plains, N. J.

Manning, Maxwell & Moore has formed an industrial controls div. The Cleveland Crane &

LITTLE BONER



Watch Your Water Tank

It was in a midwestern town where the winters can—and often do—get bitterly cold. Yes, and an unusually severe cold wave, with its biting subzero temperature, was fast spreading over the country.

The maintenance engineer, worried, stepped outside his office and looked up at the stately water tank so proudly (and publicly) bearing the company's name and emblem. The whole town could see it.

There sure would be plenty of hell to pay, he thought, if the water in that big tank should freeze and cause it to burst asunder. The mental image alone caused him to turn on his heels, stomp into his office and snap out orders to drain the tank at once.

: A quick check showed that it was none too soon; a hefty layer of ice had already formed on top of the water. Every minute counted.

water. Every minute counted.

"Snap it up," the maintenance man growled. Then slowly the water level descended. The ice disk followed.

descended. The ice disk followed.

Then suddenly the walls of the tank buckled in a sickening way. The ice disk, like a gigantic vacuum-pump piston, had expanded the air inside the tank until the walls simply couldn't take the outside pressure.

Like a kicked-in derby hat, that water tank served as a daily reminder to the maintenance engineer, the plant personnel—and to the entire town. Spring rolled around again before it could be repaired.

Do you have a true "little boner" of your own? Write the Editor, Chemical Engineering, 330 West 42nd St., New York 36, N. Y.



You get full 180° visibility . . . so you can read the liquid level from any point from which you can see the gage . . . with the New Convex Scale now available on Jerguson Truscale Remote Reading Gages. Scale markings are directly on the convex face and the indicator goes clear around the convex surface. You can stand at one end of the control room and instantly check your whole line up of Truscale Gages.

Jerguson Truscales give you instant remote readings of liquid levels of waste heat boilers, tanks, etc. . . . with the amazing accuracy of 1/2 of 1% of scale reading. And with the New Convex Scale you make these readings from any angle . . . accurately, without distortion. Truscales also available with lights, horns and Truscale Repeaters.

Write today for complete data on Truscale Gages with the New Convex Scale.

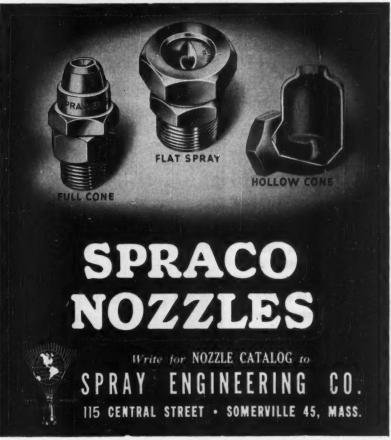




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Alsop Filters, Mixers and Tanks are available in a complete range of sizes and capacities and Alsop equipment is custom fitted to your particular application by engineers who have thorough experience in filtration and agitation. performance Look for the proved features in the benefits that Alsop Filters, Mixers and Tanks can bring to your processing operations. Write for full infor-mation, recommendations and quotations. CORPORATION ENGINEERING 1004 WHITE ROAD MILLDALE, CONN.

You'll be impressed too with these



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the WILLIAMS LINE of

COPPERAS TYPE PURE RED IRON OXIDES



- Available in 6 Shades ranging from a Light Salmon Red to a Medium Maroon R-2200, R-2900, R-3200, R-3800, R-4800, R-5800

Broad range of applications includes paints, rubber, building materials, leather finishes, plastics, paper, etc. Let our samples prove the value of these pigments. See your Williams representative or write us direct.

Compared with our other standard Copperas Reds, the "100" Series is

Brighter in color Finer in particle size Lower in all absorption Higher in purity --at no increase in price!

WILLIAMS

E. ST. LOUIS, ILL. . EASTON, PA. . EMERYVILLE, CAL.

FIRMS . . .

Eng. Co., Wickliffe, Ohio, has begun construction of a new \$500,000 shipping and receiving building.

Pure Oil Co. has started construction of a \$3 million plant to process 12 million cu. ft. of gas daily.

Brea Chemicals has begun construction on a \$2 million ammonium nitrate plant, in Calif. The plant will be owned by Amoniaco Corp.; leased to Brea.

Sharp & Dohme, Div. of Merck & Co., Inc., has centralized all operations in Teterboro, N. J.

The Lake Charles Harbor and Terminal District, La., has put into operation 8 Marietta industrial silos for processing phosphate rock.

Celanese Corp. has established a new development laboratory in Charlotte, N. C., for fiber research.

Grin Chemical Corp., Pasadena, Calif., will build a \$500,000 plant, in Seattle, to produce automotive chemicals.

Advance Solvents & Chemical Corp., New York, has purchased control of Metalead Products Corp.

Marley Co., Kansas City, Mo., has acquired controlling interest in Ajax Engineers Ltd. and Acton Structures Ltd., both of Toronto.

Pittsburgh Corning Corp. has announced plans for a \$1½ million expansion program, including a 25% increase in cellular glass production.

Worthington Corp. has located a new branch office in Detroit to handle its air conditioning equipment.

Gardner-Denver Co., Quincy, Ill., and Keller Tool Co., Grand Haven, Mich., have consolidated all assets.



STAINLESS STEEL ...fights corrosion...solves many piping problems

• Stainless steel piping, using TUBE-TURN* Stainless Steel Welding Fittings, can provide long, safe service where corrosive gases or fluids are handled. Likewise, stainless steel systems are superior where temperature extremes are encountered, for handling dangerous materials safely, for preventing contamination.

Tube Turns offers a complete line of Stainless Steel Welding Fittings in three analyses: AISI Type 304, Type 347, and Type 316; and in four schedules: 5S and 10S (thin wall), and 40S and 80S (heavy wall). For the right stainless steel welding fittings, and for help in proper application, get in touch with your Tube Turns' Distributor. You'll find one in every principal city.

TUBE-TURN Welding Fittings and flanges are made in U.S.A.
They meet <u>all</u> U.S. piping code specifications

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A Division of National Cylinder Gas Company

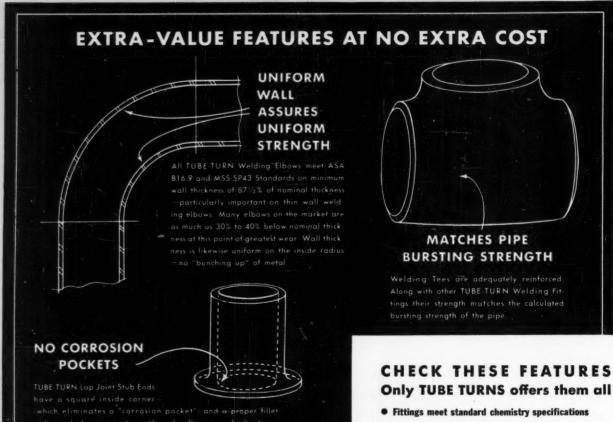
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Reg. U. S.
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STAINLESS DATA

How you get extra service from TUBE-TURN* Stainless Steel Welding Fittings



MEET ALL CODES

TUBE-TURN Stainless Steel Welding Fittings meet all specifications: ASTM A312 (for material); MSS SP43 and ASA B16.9 (for dimensions); and MSS SP25 (marking procedure).



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CHECK THESE FEATURES

- Fittings meet standard chemistry specifications
- Minimum wall thickness of elbows 871/2% of nominal
- Fittings meet minimum calculated bursting pressure of matching pipe
- Qualified welders and procedures used where welding is required
- Each fitting properly solution heat treated
- · Each fitting passivated
- Other special grades of stainless steel, and all other alloys available

All these extra value features available to you at no extra cost.

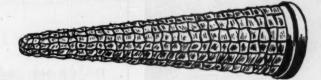


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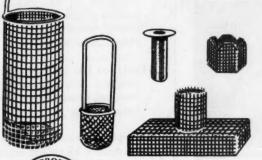
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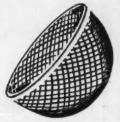
A DIVISION OF NATIONAL CYLINDER GAS COMPANY LOUISVILLE 1, KENTUCKY



WIRE-MESH PRODUCTS

for all filtering and straining applications.
All meshes, all weaves, all alloys.







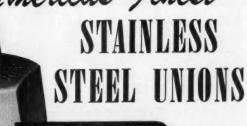
Send Specifications for an estimate. Department 15

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MANUFACTURING CORP. SOUTHPORT, COMN

again MARK is FIRST

with America's Finest



"PETRO" 304-316

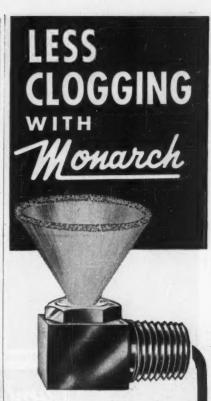
Feature Packed for Multiple Service on All Processing Where Stainless Steel Is Required

Drop forged from uniformly heated solid bars. . . . Finished to American Standard A.A.R. . . . Uniform wall thickness and concentricity maintained through quality controlled production. . . . Precision machined seats plus a differential in hardness form a perfect seal and will not seize at high temperatures. . . . Octagon shaped ends and nut provide safety from and resistance to distortion by wrench abuse.

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Monarch's advanced spray-nozzle design reduces clogging—offering efficient, dependable food processing applications to . . .

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- · DRY EGGS
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- HUMIDIFY BANANA ROOMS

Remember . . .

Make Monarch "Non-Clog" NOZZLES standard equipment for all direct-pressure spraying!

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"PETRO" DUAL

These unions are made with stainless steel ends and carbon steel

lubricated for easy make and break.



STRAINERS



SCREENS





FILTER LEAVES

Cambridge FAST, ACCURATE PRODUCTION OF WIRE CLOTH PARTS

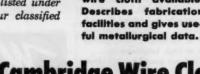
FOR FABRICATED PARTS call your Cambridge Engineers in the field, or call our home office. We'll help you select weaves, mesh sizes and metals to meet your needs and draw up prints for your OK...or, work from your prints. On small or large orders, you're assured of strict adherence to specifications by close manufacturing supervision.

A COMPLETE LINE of industrial wire cloth is available from Cambridge . . . specifications from the finest to the coarsest mesh in any metal or alloy. Uniform mesh size and accurate mesh count are assured by individual loom operation and careful inspection.

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You can get IMMEDIATE DELIVERY on large or small orders for the most frequently used types of cloth. If your needs are not in stock, we'll schedule our looms to get your material to you without delay.

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WIRE

METAL CONVEYOR BELTS

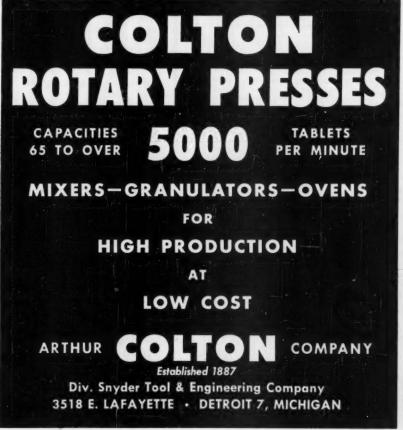
SPECIAL METAL FABRICATIONS DEPARTMENTG, CAMBRIDGE 4, MARYLAND

OFFICES IN PRINCIPAL INDUSTRIAL CITIES

FIRMS . .

- Dewey & Almy Chemical Co. has purchased 200 acres of land near Greenville, S. C., for the construction of a third plant to manufacture cryovac plastic bags.
- Westinghouse Electric Corp. has completed its \$32 million expansion program for the production of steam turbines in So. Philadelphia.
- Dorr-Oliver Inc. has centralized its divisional sales headquarters at Stamford, Conn., for its Eastern Industrial Div.
- Thompson Products, Inc. plans to construct a \$5 million engineering study center—for electronic and automotive parts—in Euclid, Ohio.
- The Carborundum Co., Niagara Falls, N. Y. has acquired the Curtis Machine Corp., manufacturer of belt sanders and rubbing machinery.
- The Duriron Co., Inc., Dayton, Ohio, has purchased the assets of the Enzinger Union Corp., Angola, N. Y., stainless steel filter manufacturer.
- AC-Lab Equipment Co., Bronx, N. Y., has purchased the Curtis W. Shields concern-manufacturer of sterilizing equipment.
- Solway Chemicals Ltd., subsidiary of Marchon Products, has opened a mine to supply anhydrite to the firm's new \$5½ million sulfuric acid plant in Cumberland.
- Montecatini Chemical Co., Italy, has concluded agreements with Venezuela for the construction of a fertilizer factory.
- U. S. Rubber Co. plans to build a new branch office and warehouse on property acquired from Cincinnati Chemical Works, Inc.
- Consolidated Chemical Co. has put its new aluminum sulfate liquor plant on stream, in Hous-







With INDEPENDENT'S newly-designed generators, you can make your own high-purity oxygen and nitrogen from the free air . . . and in the same generator.

You reduce costs up to 50% by eliminating handling costs . . . vaporizing costs . . . evaporation losses . . . residual losses . . . and transportation costs.

INDEPENDENT Generators are available in any capacity, any purity and any pressure. Put your oxygen-nitrogen problem up to us... our engineering department will gladly submit recommendations ... no obligation, of course!

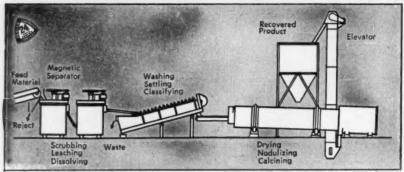
INDEPENDENT ENG. CO., Inc.



O'FALLON 7, ILLINOIS

Denver Reclamation Systems

take dollars out of your wastes



If you have valuable materials in your wastes, Denver Reclamation Systems can make recovery profitable. Also, present reclamation systems can be economically modernized.

- Complete testing, engineering and design services.
- Wet or dry systems.
 Complete fabrication facilities.
- Catalogs and Brochures on Request!

DECO can supply engineering, laboratory testing, process development and equipment for crushing, grinding, concentration, separation and recovery, settling, filtering, drying and related processes.

Also, complete line of laboratory and process equipment such as:

		SIZES	
DENVER Steel-Head BALL MILL		3'x 2' to 6'x 12'	A Denver Steel-Head Ball Mill will sult you particular need. Five types of discharge trun nions. All-steel construction. Low initial cos due to quantity production. Quick delivery Laboratory and pilot plant mills also avail able. Please write for Bulletin No. 52-B13
DENVER Spiral Rake THICKENER		3'x 3' to 80'x 12'	Enclosed, running-in-oil head motion. Pat ented spiral rakes, move settled solids to center discharge with continuous motion rapid removal of solids tends to eliminat overload. Wood, Steel or Rubber-lined Tank available. Write for Bulletin No. T5-85
DENVER Batch and Continuous TESTING		Laboratory and Pilot	Use Denver Testing Laboratory facilities for complete batch or pilot tests—your engineer or ours. Ample test facilities for investigations on crushing, grinding, mixing, classification, separation, sampling, leaching, concentration, thickening, filtration and drying Consultation is without obligation. Pleas write for Bulletin No. T4-B15.
DENVER Rubber Lined PUMPS		Up to 2400 G.P.M.	Denver (Soft Rubber Lined) Sand Pump lower pumping costs 30% to 70% due to simple design, lighter weight and accurace of rubber parts which increase officience 1½ to 3 times over other sand pumps. Hav molded rubber impellers and casing liner for long life. Write for Bulletin No. P9-Bit
DENVER- DILLON Vibrating SCREENS	*	1'x 3' to 6'x 14'	Gives fast, clean separation without blind ing. Gives even, smooth flow of materic because of the patented "true-circle" eccentric action. Two-bearing construction save 50% HP. Please write for Bulletin No. 53-B11

"The firm that makes its friends happier, healthier and wealthier"



FIRMS . .

ton, Tex. The firm's new sludge acid plant will begin operations this month.

Purex Corp., Ltd., will build a onestory 2200 sq. ft. addition to its St. Louis liquid detergents plant.

National Can Corp. purchased the Pacific Can Co. in a \$19 million transaction. National is now third largest in the indus-

Atlas Powder Co. has opened its new general offices at Concord Pike and New Murphy Rd., Wilmington, Del.

Reliance Electric & Eng. Co. has negotiated for the acquisition of the Reeves Pulley Co., Columbus, Ind.

Borsod Chemical Works, Hungary, is now testing a new ammonia synthesis plant.

Shell Petroleum Co. has completed its \$500,000 plant, for the extraction of sulfur from natural gas, in Alberta, Canada.

ACF Industries, Inc. has completed new facilities for the manufacture of pressure vessels.

Kaiser Aluminum & Chemical Corp. has begun construction work on its \$6 million fume control system at the Chalmette plant.

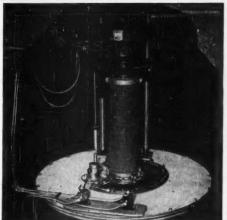
Warren Steam Pump Co., Warren, Mass., manufacturer of centrifugal and rotary pumps, will open a Boston, Mass., office.

R. M. Hollingshead firm, manufacturer and distributor of maintenance chemicals has established a new regional sales office in New York.

Clark Bros. Co., Olean, N. Y., has opened an Atlanta district office for its heavy duty engines and compressors.

Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., has

letcher PNEUMATIC UNLOADER CENTRIFUGALS



The latest Fletcher development in its line of modern high-speed centrifugals is the use of pneumatic controls to greatly ease and simplify unloading operation. By this means the back-breaking and fatiguing hand cranking operation is eliminated, and the operator's efficiency is materially increased. The scraper is at all times under complete control.

The air-operated unloader also simplifies the design of a fume hood for noxious gases.

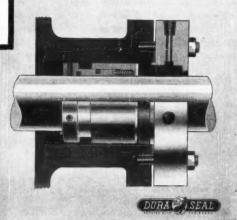
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A Single Balanced Mechanical Seal for Light Hydrocarbons at High Pressures...

Now - perfect sealing for pumps handling light hydrocarbons up to 600 lb. pressures. Can be installed on your present equipment - no special sleeves or machining required.



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HIGH VACUUM PRODUCTION and MEASUREMENT

25 years experience in the power vacuum tube business with recognized leadership in exhaust processing, is available to you with Litton High Vacuum equipment.



Vapor Pumps · Traps Vapor Pump Oils

Vacuum Measurement equipment

Model PB Pump, less valves and charcoal \$268.00 f.o.b. Grass Valley, Calif.

Charcoal Baffle Assembly \$53.00 f.o.b. Grass Valley, Calif.

- All Metal High Speed Oil Vapor Pump.
- Sectionalized Combinations for Charcoal Cell, Water Baffle, Valves, straight or an-gle Manifold connection.
- Liquid cooled, insuring uniform results regardless of environment.
- Interchangeable heaters: any voltage.
- Use with any organic medium.



MODEL L-3032 VACUUM GAUGE \$75.00 f.o.b. Grass Valley, Calif.

- Phillips type gauge.
- Built-in magnetic field.
- Built-in heater for outgassing after long idleness, or contaminating runs.
- Adapted to metal or glass systems.
- No tungsten clean-up.
- No filament burnout.
- · Repeatable measurements.

Day in, day out dependable, rugged produc-tion or long idle and intermittent laboratory use, with consistent dependable results.

Built to take it!



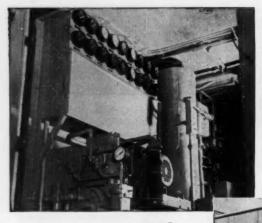
MODEL 4301 VAC GAUGE AMPLIFIER AND CALIBRATION UNIT \$255.00 f.o.b. Grass Valley, Calif.

A rugged production unit with all controls necessary for the outgassing, calibration and operation of the L-3032 gauge.

The demand for long shelf life and dependable snap-on operation of vacuum tubes is bringing to a close the day of mediocrity in vacuum procedure.

Let us help you in modernizing your techniques and equipment to meet these competitive





An interior and exterior view of a mobile trailer unit fitted with a CO₂ generator manufactured by the Gas Equipment Engineering Corp.

For rugged, trouble-free Refrigeration used in MOBILE CO₂ PLANTS



7 CHECK with VILTER

An adequate and dependable supply of carbon dioxide for fire fighting equipment is a vital standby need at airports, military installations, and industrial plants.

One of the outstanding mobile units engineered to meet these requirements is the special trailer unit fitted with a carbon dioxide generator manufactured by the Gas Equipment Engineering Corp. of Mount Vernon, New York. Through catalytic action this portable unit furnishes in the field a ready supply of carbon dioxide liquid, as well as hydrogen. Important components of this design are the Vilter 7½ hp condensing unit and the Vilter low temperature carbon dioxide liquefier.

The flexibility and reliability of the Vilter units made them a natural choice for this job. Everywhere in industry Vilter is known for its Quality products...designed for efficient operation...requiring a minimum of maintenance—both helping to reduce operating costs. For help in your designs, check with Vilter.



Your nearby VILTER Representative of Distributor will be glad to show you how VILTER refrigeration can help you,

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, MILWAUKEE 7, WIS.

Air Units • Ammonia & Freen Compressors • Booster Compressors • Baudelot

Coolers • Water and Brine Coolers • Blast Freezers • Evaporative & Shell & Tube

Condensers • Pipe Coils • Valves & Fittings • Pakice and Polarflake Ice Machines

FIRMS . . .

begun operations at its new assembly plant in Independence, Iowa.

Witco Chemical Co. has acquired the chemical div. of The Emulsol Corp. and has reorganized it as the Emulsol Chemical Corp.

Harshaw Chemical Co. will negotiate for the acquisition of Zinsser & Co., manufacturer of toners, dyes and tannin.

Allis-Chalmers Mfg. Co., Milwaukee, plans to purchase the Baker Mfg. Co., Springfield, Ill.

Nat'l Starch Products Inc., New York, has awarded a contract for a polyvinyl acetate polymer plant to be erected in Meredosia, Ill., to the Blaw-Knox Co.

American Latex Products Co., Hawthorne, Calif., has begun a \$500,000 expansion program to provide for foam rubber and polyurathene facilities.

Calumet Nitrogen Products Co. has awarded a contract to the Fluor Corp. Ltd. for new anhydrous and ammonium nitrate facilities in Hammond, Ind.

E. I. du Pont de Nemours & Co., Inc., will begin construction on a \$2,800,000 rubber sales-service laboratory in Wilmington, Del.

Standard Chemical, Ltd., has bought the chloride and caustic soda mfg. plant, Quebec, of Dominion Tar & Chemical Co., Ltd.

Michigan Chrome & Chemical Co., Detroit, has opened its new laboratory for the development of micro products and plastisols.

The Jeffrey Mfg. Co., Columbus, Ohio, has opened a western territory sales office in San Francisco.

Marbon Chemical Div., Borg-Warner Corp., plans to acquire an option on a plant site at Washington, W. Va.



The new Model MCR is the king of heavy duty filters

Heavy residue products are handled with ease and the cake can be discarded in a semi-dry state. If you haven't seen this filter operate it is hard to believe how fast and easy it is to open and clean. One lever releases all head bolts simultaneously. One switch control gives a smooth power retraction of the tank exposing the plates for convenient cleaning. The complete opening is accomplished in less than one minute.

Everywhere the MCR filter has been installed filtering costs have dropped materially. And the daily production output increased as much as 300% as reported by one brewery using the MCR for primary filtration of beer.

Ask for proof of this amazing new economy in filtration with your product.

Write Mr. Eric Anderson for personal service

SPARKLER MANUFACTURING CO. MUNDELEIN, ILL., U. S. A.

Sparkler International Ltd. • Plants at Galt, Ontario, Canada, Amsterdam, Holland



Operating and cleaning the MCR is a white collar job.

OLDBURY

Set to serve . : .

An industry, to do its job well, must give of its "mind-power" as it does of man power and machines. This we do.

How may our chemicals serve customers better? Where may we provide the chemical means to help solve new formulation problems in industry . . . in agriculture . . . or wherever? Pure, uniform, reliable as any product bearing the Oldbury name must be, our "mind-power" is here as well to serve you in confidence so that Oldbury products may serve you in fullest measure.

ELECTRO-CHEMICAL COMPANY

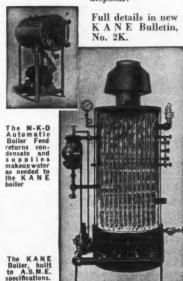
Executive Offices: NIAGARA FALLS, NEW YORK Sales Office: 19 RECTOR STREET, NEW YORK 6, N. Y. Plants: NIAGARA FALLS, N.Y. COLUMBUS, MISS.

IS YOUR FLOOR SPACE AT PREMIUM? ERTICAL

chances are that floor space is at a premium in your shop or plant . so, you needn't be robbed of this valuable space by a cumbersome, horizontal type boiler . . . not when a KANE vertical BOILER PACKAGE will give you the same or probably better results.

The KANE BOILER PACKAGE includes: the correctly sized Automatic Gas-Fired Boiler complete with gas burner and controls to maintain required steam pressure; and an M-K-O Automatic Boiler Feed system designed to return condensate and supply make-up water as required for highest operating efficiency.

"Engineered Steam at its best, with over 50 years of experience at your disposal!"





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Sales Office: 108-22 Queens Blvd., Forest Hills 75, N. Y.



Colmonoy Spraywelding Hard-Faces Valve Plugs



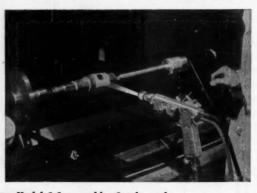
Hamer valve plugs shown after finish grinding of the Colmonoy overlay.

The Colmonoy Spraywelder is a metal spraying unit for applying powdered Colmonoy alloys. These alloys impart superior abrasion and corrosion resistance to finished metal parts. After spraying, the overlay is fused to the part with an oxy-acetylene torch. The Hamer set-up above shows a plug being sprayed while rotating in a lathe.

Longer valve plug life is a goal sought by everyone concerned with valves in the process industries. Hamer Valves, Inc. (California), makers of valves for the petroleum and chemical industries, reports new success in this field.

They're hard-facing valve plugs with Colmonoy No. 4 alloy, applied with the Colmonoy Spraywelder. These Spraywelded plugs last 3 to 4 times longer than hard-chrome plated plugs.

The cement-slurry valve plugs (above) are shown after the Colmonoy overlay was sprayed and fused. The close tolerance spraying will require little grinding to bring plugs to size.



Write for the new Model C Spraywelder Catalog today.

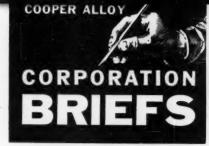
HARD-FACING ALLOYS

19345 JOHN R STREET WALL COLMONOY DETROIT 3, MICHIGAN
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FIRMS . . .

- Abbott Laboratories has opened a new sales and distribution center for New England, in Boston.
- Phelps Dodge Refining Corp., New York, has opened a warehouse in Chicago for all grades of copper and nickel sulfate.
- Oxy-Cataylst, Inc., has opened a Los Angeles, Calif., office to handle its air pollution control devices.
- International Minerals & Chemical Corp. has purchased all assets of the U. S. Mining Co. and the Peerless Perlite Co., Los Angeles.
- American Brass Co. plans to construct a \$25 million aluminum fabricating plant in Terre Haute, Ind.
- Kennedy Car Liner & Bag Co., Inc., Shelbyville, Ind., has purchased the Justice-Doyle Co., manufacturer of polyethylene bags.
- American Brass Co. plans to construct a \$2½ million plant in Mattoon, Ill., to produce flexible metal hose and tubing.
- Pantex Mfg. Corp., Pawtucket, R. I., has acquired the Livingstone Eng. Co., Worcester, Mass., steam jet cleaner manufacturer.
- Diamond Alkali Co. is now modernizing key research facilities in Painesville, Ohio, at a cost of \$200,000.
- Vick Chemical Co. will purchase the Dr. Hess & Clark Inc., a leading manufacturer of pharmaceuticals and feed supplements.
- Thunderbird Refinery, Arizona, plans to build a \$30 million plant if it can tap a spur of a So. Pacific pipe line for crude oil supply, near Phoenix.
- Western Plywoods Co. Ltd., Vancouver, has purchased all issued shares of Murray Plywoods Ltd. for \$595,000.



• Edited by GEORGE BLACK

VALVES IN PAPER AND PULP

Chief Engineer of Cooper Alloy's Valve and Fitting Division, Perc Shaffer, recently delivered one of the most comprehensive lectures on the subject of stainless steel valves in the pulp and paper industry. It was printed in toto in the Pulp and Paper Magazine of Canada, and is now available in reprint form from our technical librarian.



V2B AVAILABLE IN NEW FORMS

A short while back we licensed both Janney Cylinder Company and Crucible Steel Company of America for the production of V2B centrifugally cast cylinders and wrought forms respectively. We're pleased to announce that tests conducted by both companies show our own data to have been conservative. If your product requires a gall and corrosion resistant stainless alloy—with a hardness of 363 Brinell and better—we suggest you contact Janney, Crucible or ourselves for the facts on V2B.



NEW CHEMICAL PUMP

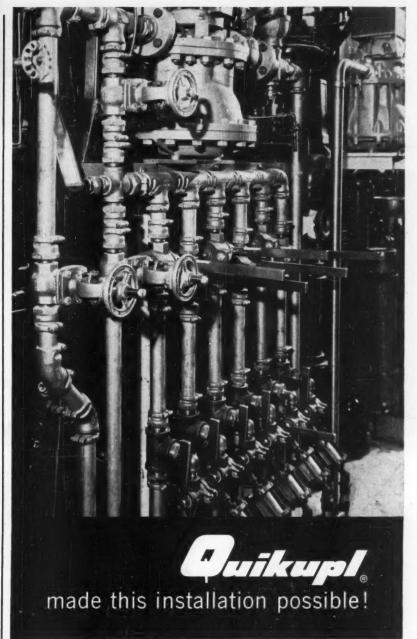
Vanton Pump & Equipment Corp. has announced a new pump design which combines the basic self priming, no stuffing box, no shaft seal features of the standard "flex-i-liner" with a construction that permanently protects all bearings from fumes, or chemical attack. Details of the new XB (external bearings) model, which is available in capacities from fractional to 5 gpm with 0-50 psi discharge pressures, is available on request.



COOPER ALLOY

CORPORATION . HILLSIDE, N. J.

CB.5



Take a good look at this manifold installation which forms part of the modern de-ionization system at the Johnson and Johnson Baby Products plant in Cranford, New Jersey. Its neat, compact appearance tells more than words.

Put up in a jiffy, without threading, welding or flaring, in a room less than three feet wide, QUIKUPL stainless steel fittings enabled Plant Engineer Stephen Baksa to install more than 300 feet of $1\frac{1}{2}$ O.D. stainless tubing in record time and at low cost. "When you take installation into consideration," says Mr. Baksa, "QUIKUPL costs are so low that I even specified them on the drain line."

Find out how QUIKUPL can save you valuable installation time and dollars. Write for Bulletin Q100 today!



COOPER ALLOY CORPORATION · HILLSIDE, N. J.

Valve & Fitting Division

FOAM'S a FUGITIVE



from DOW CORNING ANTIFOAM AF EMULSION



Given a chance, a Dow Corning silicone defoamer almost always gets its man... restores productive capacity previously wasted on foam . . . reduces processing time . . . eliminates hazardous boil-overs ... and at very low cost. For example:

- 12 ppm defoam cottonseed oil
- 4 ppm defoam fermenting wheat
- 4 ppm defoam neoprene latex
- 4 ppm defoam paper sizing
- .07 ppm defoam vat dies

The more easily dispersed Antifoam AF Emulsion and its parent product, Antifoam A Compound, are physiologically harmless. Effective at low concentrations against the widest variety of foamers, they pay for themselves many times over.

see for yourself . . .

DOW CORNING

mail coupon today for

free sample

SILICONES Dow Corning Corporation Midland, Mich., Dept. 2604

Please send me data and free sample of Dow Corning Antifoam A Compound

or Dow Corning Antifoam AF Emulsion

COMPANY.



You can depend on WIEDEKE quality





That's the output of the big new plant at Luling, La. Most of the anhydrous ammonia is converted to pellets of ammonium nitrate, and used for fertilizer. The better crops resulting repay the cost of the ammonia to the farmer as many as four times.

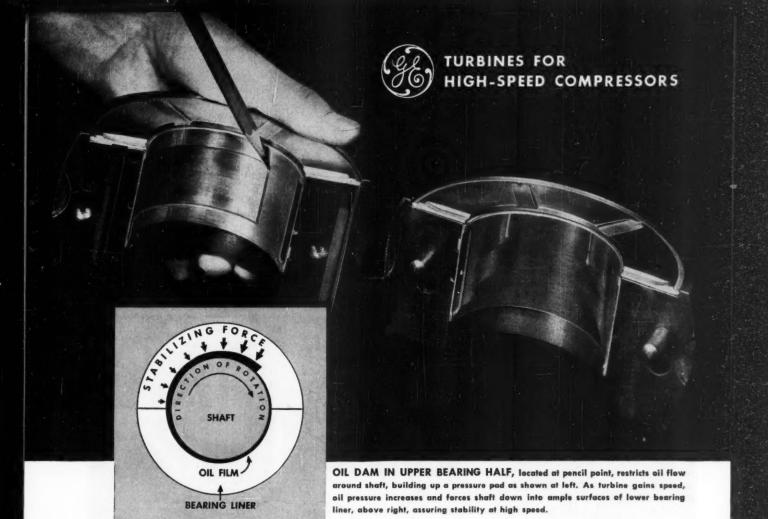
Three complete Frick cooling systems, each with a 125-hp. compressor, serve this plant.

The process industries find Frick refrigeration, ice making, quick freezing, and air conditioning indispensable in many ways.

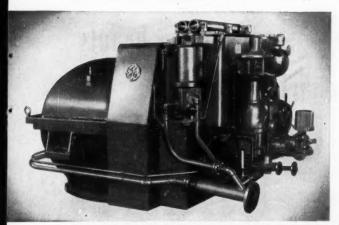
If you have a cooling problem, let the nearest Frick Branch or Distributor

submit recommendations. Or, write direct to





Large pressure-pad bearings add years of life to G-E high-speed turbines



TYPE DRV HIGH-SPEED MECHANICAL-DRIVE TURBINE

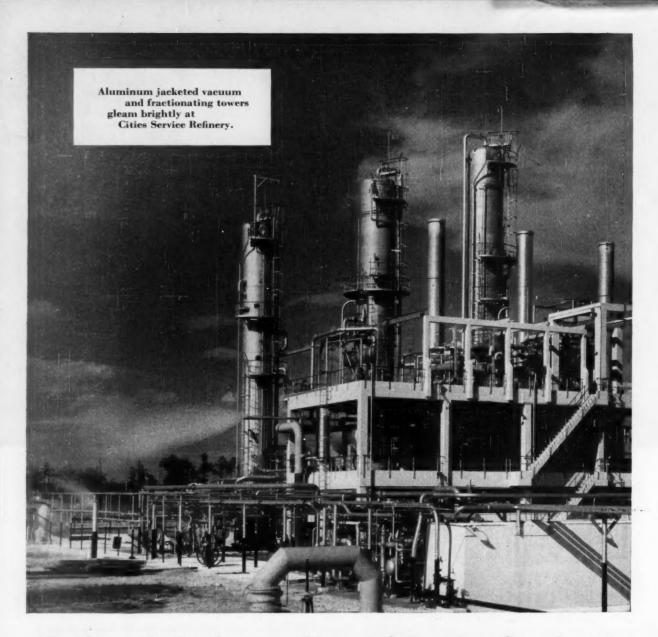
To provide longer, more reliable service, all G-E high-speed turbines incorporate large pressure-pad bearings. The generous surfaces of the bearings assure low unit loading for ample lubrication and minimum wear during start-up.

As turbine speed increases, the viscous pump action of the shaft carries oil into the cavity, building up a pressure pad. This forces the shaft down into the lower bearing half, thus minimizing the possibility of vibration, with its detrimental effect on bearing and packing life.

This is only one of many design features that make a G-E high-speed turbine your most reliable drive for compressors and blowers. For more information contact your nearest G-E Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y. In Canada, contact Canadian General Electric Company, Limited, Toronto.

Progress Is Our Most Important Product

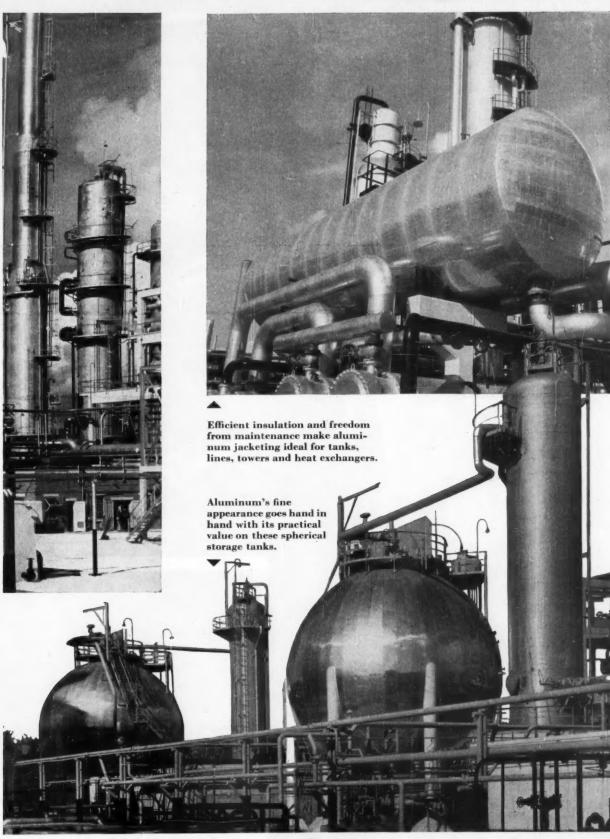
GENERAL ELECTRIC



Aluminum jacketing provides maintenance-free beauty in Cities Service Lake Charles Refinery

Selected because of its freedom from maintenance and lasting good looks, shining rust-proof Reynolds Aluminum is used throughout the Cities Service Lake Charles Refinery, often called the most beautiful in the world. Aluminum jacketing used on heat exchangers, high pressure steam lines, vacuum towers, hot oil lines, fractionating towers, feed tanks and pumps provides freedom from maintenance, efficient insulation in addition to easy original application.

Light weight and non-sparking qualities make aluminum ideal for walk-ways and tank decks. Its high heat transfer and resistance to corrosion lend themselves to a wide variety of process applications. For more information on aluminum in the process industries, call the Reynolds office listed under "Aluminum" in your classified telephone directory. Or write to Reynolds Metals Company, 2567 South Third Street, Louisville 1, Kentucky.



REYNOLDS



ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND



FACT:

The new <u>life-Line A</u> has stronger insulation than any other motor on the market

Meaning what? Simply that the new Westinghouse Life-Line® "A" motor with new fortified insulation can withstand heavier overloads and operate at higher temperatures than any other motor you can buy.

Similar design advances in the mechanical and lubrication systems make Life-Line "A" industry's most preferred motor.

It takes the right combination of all three systems—electrical, mechanical and lubrication—to build the best package of power on the market.

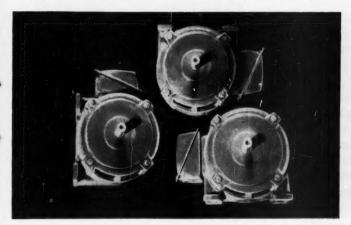
Get all the facts by calling your Westinghouse sales engineer..:

The Man With The Facts!

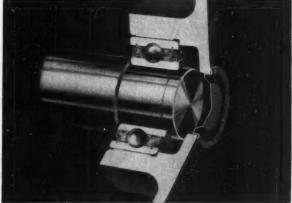
J-21877

Westinghouse





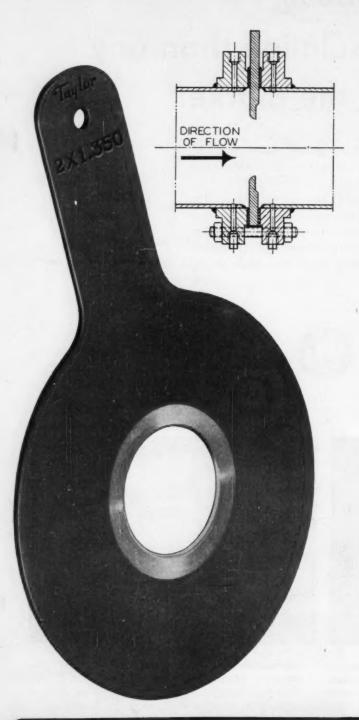
Mechanical System Fact: New cast-iron housing on both drip-proof and totally-enclosed types. Ventilation openings only in end brackets make the motor dripproof whether mounted on floor, ceiling or wall.



Lubrication System Fact: New "4-way sealed", prelubricated bearing eliminates completely the 3 main causes of bearing failure: 1) contamination, 2) over greasing, 3) wrong grease.

New improved measurement of

LOW FLOWS WITH VARYING VISCOSITY



AS A RESULT OF TAYLOR'S BROAD EXPERIENCE WITH QUADRANT EDGED ORIFICE

HE Quadrant Edged Orifice is the result of considerable effort to find a primary element suitable for low Reynolds number flow measurement. This type of flow is encountered when viscosity is a factor both in magnitude and variation. The orifice edge has a rounded approach on its upstream face making it practically insensitive to viscosity changes so long as the throat Reynolds number does not exceed 250,000. For all practical purposes it has a constant coefficient over the Reynolds number range of 5000 to 250,000. Calibration curves are therefore unnecessary-standard square root charts can be used even on low flows. This constant coefficient characteristic permits the use of an integrator in the recorder or a planimeter with the charts.

Our experience has shown that unusual machining skills are required to produce this type of orifice satisfactorily—the edge contour being extremely important. If you have flow measurement problems that could benefit from the use of this Quadrant Edged Orifice, we suggest you submit them to Taylor for analysis and recommendation. Meantime write for technical bulletin to Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and bumidity.

Taylor Instruments MEAN ACCURACY FIRST



Faster, more power,

and LOOK, NO CLUTCH!



It's a pleasure to work here!

- Power-shift levers: for Forward-Reverse and High-Low; make any shift while moving in either direction.
- 2 That's no clutch! It's a doublepedal brake, use it with either foot.
- 3 Break-out bucket lever: work the bucket in the pile—you've got two big double-acting bucket cylinders for tremendous breakout power, independent low-level tip back.
- Range Shift: working or travel speed
- 5 Drive Selector: 4-wheel and 2-wheel
- 6 Boom Control

Until you see a MICHIGAN in action, you won't believe that it's possible to deliver so much power with such ease of operation. Your driver stays at peak efficiency all day long because there's no conventional clutch on a MICHIGAN. Instead, the MICHIGAN's exclusive power-shaft transmission does all the shifting hydraulically—and eliminates the most notorious cause of excessive maintenance and driver fatigue.

In addition to effortless, instantaneous shifting, you get up to 300% torque multiplication on a MICHIGAN—from the Clark-built converter. With this kind of smooth, shockless power transmission, you get the full advantage of the MICHIGAN's extra weight and higher horsepower.

A demonstration (on your own job, if you wish) is the only way to get a real understanding of what this machine can do! Just write or call us—and don't forget that all MICHIGAN's are available on the low-cost MICHIGAN Lease Plan.



CLARK EQUIPMENT COMPANY

Construction Machinery Division 432 Second St., Benton Harbor 28, Michigan Phone: WA 6-6184



Need corrosion resisting Plate or Sheet?...Write your

Inco Distributors Throughout North America

Atlanta 3—J. M. Tull Metal & Supply Co.
Buffalo 7—Whitehead Metal Products Co., Inc.
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Cambridge 39, Mass.—Whitehead Metal Products Co., Inc.
Chicago 23—Steel Sales Corporation
Cincinnati 29—Williams and Company, Inc.
Cleveland 14—Williams and Company, Inc.
Columbus 8, Ohio—Williams and Company, Inc.
Columbus 8, Ohio—Williams and Company, Inc.
Columbus 8, Ohio—Williams and Company, Inc.
Dallas 9—Metal Goods Corporation
Denvict 10—Steel Sales Corporation
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Edmonton, Alberta—Wilkinson Company, Ltd.
Grand Rapids 2—Steel Sales Corporation
Harrison, N. J.—Whitehead Metals Products Co., Inc.
Houston 3—Metal Goods Corporation
Indianapolis 2—Steel Sales Corporation
Indianapolis 2—Steel Sales Corporation
Indianapolis 2—Steel Sales Corporation
Indianapolis 13—Steel Sales Corporation
Mineagolis 13—Steel Sales Corporation
Mineagolis 13—Steel Sales Corporation
Mineagolis 13—Steel Sales Corporation
Montreal 1, Que.—Robert W. Bartram, Limited
New Haven 13—Whitehead Metal Products Co., Inc.
Philadelphia 40—Whitehead Metal Products Co., Inc.
Philadelphia 40—Whitehead Metal Products Co., Inc.
Philadelphia 40—Whitehead Metal Products Co., Inc.
Portland 12, Ore.—Eagle Metals Company, Itd.
San Diego 1—Pacific Metals Company, Itd.
San Diego 2—Williams and Company, Inc.
Ioronto 5, Ont.—Alloy Metal Sales, Limited
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Go ahead! Write your own ticket.

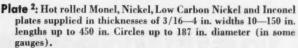
Corrosion resistance? Alloys that resist nearly every form of corrosion . . . Monel, Nickel, Inconel, Incoloy, and many others. And now Inco's newest development, Nionel for hot acid solutions and oxidizing corrosives.

Mechanical properties? Everything you need . . . strength and toughness comparable to steel ... resistance to temperatures up to 2200°F, and to abrasion, erosion, wear, galling. You name it.

Working properties? No problem. You can form, forge, or machine these alloys, join them by all commercial methods. You can get complete and detailed in-



A wide range of sizes1



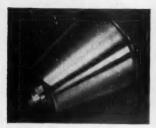
Lukens Clad Steels 3: Nickel-Clad Steel plates supplied in thicknesses of 3/16-2 in., widths 48-178 in., lengths up to 480 in. Circles up to 178 in. (in some gauges). Inconel- and Monel-Clad plates 3/16-2 in. thick, 48-162 in. wide, up to 480 in. long. Other gauges on application. Circles up to 162 in. (in some gauges).

Sheet: Cold rolled Monel, Nickel, Low-Carbon Nickel and Inconel sheets supplied in thicknesses of 0.018-0.250 in., widths up to 60 in., lengths up to 178 in. . . . except Inconel, with a maximum length of 144 in. Circles produced as sheared or machined, up to 60 in. Half circles also made.

1 Limitations on Nionel are supplied on request. 2 Greater widths, lengths and thicknesses can in some cases be secured. Not all thicknesses available in all widths or lengths. 3In addition to wide plates, Lukens also supplies flanged and dished heads up to 18 ft. and larger.



Purity protection. This compartmented nickel trailer tank moves benzyl chloride. keeps it pure with no inhibitor needed.



Easy to deep draw. Easy to spin Monel, too. Thus it is practical to use Monel for this 4-inch funnel which must resist corrosion and sparking. The piece is used to fill fragmentation bombs with TNT.



Weldable to steel. Monel is also compatible with coppernickel alloy tubing ... ideal for tube sheets like this. Fabricator saves work, time, and money by making them from Monel metal circles.



Joining no problem. Just write for these Inco Technical Bulletins on joining Nickel and High Nickel Alloys: T-2...on fusion welding T-33...on resistance welding T-34...on brazing and soldering

own ticket with inco Nickel Alloys

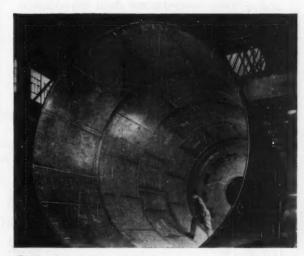
formation from Inco Technical Bulletins.

Sizes and forms? The wide range listed is only part of the story. You also have Lukens Clad Steels for reactors, towers, heat exchangers and other large vessels. They can save you up to 50% in cost of materials. From other metal processors you can get strip and sheet in very small gauges and in such special forms as perforated or expanded.

Easy to order? Certainly. Just call the nearest Inco distributor listed bottom left.

THE INTERNATIONAL NICKEL COMPANY, INC. New York 5, N. Y. 67 Wall Street

MONEL® . "R"® MONEL . "K"® MONEL . "KR"® MONEL "5" MONEL . INCONEL® . INCONEL "A"® . INCONEL "W"® INCOLOY® . NIMONIC® Alloys . NICKEL LOW CARBON NICKEL . DURANICKEL



Corrosion resistant. The top section of this petroleum refinery fractionating tower is protected against attack from dilute acids by its Monel lining.

FIRST instrument system BASIC GRAPHIC-PANEL

It's BRISTOL'S new metagraphic instrument system

A WIDE SELECTION: For example, there are 35 receiver and 34 controller models and the widest variety of transmitters on the market. A model can be found among these that will exactly meet any requirement.

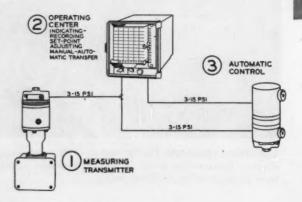
FULL PLUG-IN SERVICE: Change recorder to an indicator or vice versa in 10 seconds with ABSOLUTELY NO INTERRUPTION WHATSOEVER TO AUTOMATIC CONTROL.

Pull complete chassis out (one piece chassis — no tools required). With chassis removed you get the same automatic control as before.

Change from one model to another or if trouble is suspected in a plug-in unit, the doubtful unit can be replaced by a spare while the suspected unit is checked in the service shop — out-of-service time is thus eliminated.

CONTINUOUS VALVE POSITION INDICA-

TION on same instrument scale as set point scale, gives continuous data on control valve position—makes "bumpless" transfer possible, simply by matching pointer positions—no need to read actual scale values—minimizes reading errors—speeds operations.





SUPPLIED IN A VERY WIDE VARIETY OF SPANS AND RANGES: For example, absolute pressure instruments are made in ranges as low as 5mm mercury absolute. Pressure instruments as low as 5 inches water to 10,000 psi. Over-range protection available up to 400% over range.

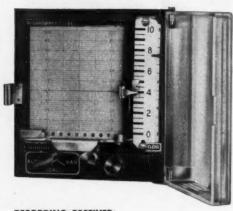
STANDARD BRISTOL MEASURING ELEMENTS ARE USED — high torque, wide-angle travel gives powerful, positive operation. Very sensitive — as little change as 0.03% of range, including reversal.

METAGRAPHIC INSTRUMENTS MEASURE, RECORD, INDICATE, AND AUTOMATICALLY CONTROL

Pressure Liquid Level
Vacuum Flow

Absolute Pressure Temperature and
Differential Pressure Mechanical Motion

that carries out idea completely!



RECORDING RECEIVER:
Also furnished as an Indicator

NO INTERRUPTION WHATEVER TO AUTOMATIC CONTROL when receiver chassis is removed. The chassis of a Metagraphic Receiver is plug-in construction and can be changed from a recorder to an indicator or back in a matter of 10 seconds.

OFFERED FOR UP TO 3 MEASURED VARIABLES — with air pressure regulators or air-loaded regulators — three-position manual-automatic transfer valves for automatic control and six-position (on the same knob) transfer valves for cascaded control.

ALL MEASUREMENTS ON SAME SCALE PLATE: Deviation of pointers shows at a glance conditions of control — no need to read scale.



VARIETY AND FLEXIBILITY: The most flexible and complete line of controllers offered — 34 different models, including the following variations:

- 1. Remote set-point
- 2. Integral set-point (with or without air-loading)
- 3. Pipe-connected
- 4. Plug-in receiver mounted
- 5. Plug-in pipe or surface mounted
- 6. Five models of control action as follows:
- a. On-Off
- b. Adjustable proportional
- c. Adjustable proportional plus reset
- d. Fixed proportional plus reset
- e. Proportional plus reset plus rate (derivative)

Write for our product data sheets. The Bristol Company, 109 Bristol Road, Waterbury 20, Conn.

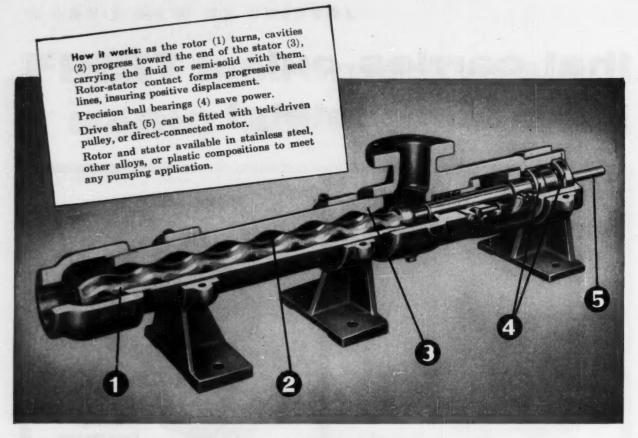
6.5.2

BRISTOL POINTS THE WAY IN HUMAN-ENGIN

BRISTOL'S

POINTS THE WAY IN
HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS



If your pump requirements are a little different...

The entirely different MOYNO® Pump may be exactly what you need!

FACTS ABOUT THE MOYNO

the world's simplest pump

- Positive Displacement—Moynos are available to pull up to 29 inches of vacuum while discharging under pressure. Big Moynos can deliver up to 250 gallons per minute, against pressures up to 600 p.s.i.
- Gentle—no churning, foaming; won't break up semi-solids.
- Reversible—pumps with equal efficiency in either direction.
- Trouble-Free—self priming; won't cavitate or vapor-lock. Just one moving part—no valves to stick, no pistons to gum up. Built for tough service, easy to maintain.
- Versatile—handles liquids, pastes, abrasive-laden slurries, vacuum applications

You name the problem! Are your pumped materials viscous, semisolid, hard to move? Do they tend to disintegrate? Are they abrasive? Do pump maintenance costs seem high? If "yes" is the answer to any of these, find out why Moyno Pumps handle jobs where other pumps fail!

The Moyno is different! The cutaway view above—and the facts listed at left—describe a completely new concept of pump design. They show why the Moyno is a pump you can specify, install and forget.

Will it solve your problem? Chances are it will...at least there isn't a more versatile pump made! Moynos pump clay for a leading pottery maker. They're being used for handling white water in paper mills...for caustics...an Eastern food producer is even using them successfully for pumping potato salad!

Get more facts today! An interesting, factual bulletin will tell you more about the simple, versatile Moyno Pump. Write for your free copy of Bulletin 30-CE

ROBBINS & MYERS, INC.

SPRINGFIELD 99, OHIO . BRANTFORD, ONTARIO







lectric



Hoists & Cranes



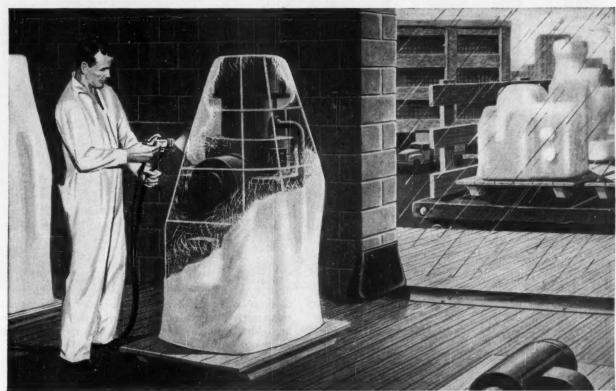
Moyno



Propellair Industrial

EXON: each resin engineered for a specific problem





Using one resin instead of two spells economy for compounders of strippable vinyl coatings. New EXON 450 makes this possible. It simplifies compounding techniques because this one resin provides good solubility, film tensile strength and durability in the formulations based on it.

To assure product protection from dust, dirt, moisture, grease and weathering —both industry and government* are making extensive use of spray-applied vinyl wrappings made with EXON 450.

Easy to use, easy to remove! Strip coatings made from EXON 450 can be spray-applied from various solvent combinations and require no further maintenance. When the coating is stripped or peeled off, the product is left clean and ready for immediate use.

For complete information or technical service on the ever-growing line of EXON resins, call or write:



CHEMICAL SALES DIVISION
FIRESTONE PLASTICS COMPANY, POTTSTOWN, PA., DEPT. 28M
DIVISION OF FIRESTONE TIRE & RUBBER CO.

*EXON 450 meets Government Specification MIL-B-12121



Firestone

strength...

just one of many reasons why Kaylo, is the king of high temperature insulations



Boiling water will not break Kaylo down. When soaked, it retains much of its strength. Dried, it returns to its original thermal efficiency.

Tested in thousands of industrial applications, Kaylo has flexural strength, compressive strength and resistance to abrasion far above normal requirements for heat insulation. It is a flawless performer at all temperatures up to 1200°F... through the hot water and low-pressure steam ranges and through the super-heated steam range. Its low coefficient of conductivity is the result of the smallness and number of its insulating air spaces, which present a material internal surface of approximately 100 acres per cubic foot.

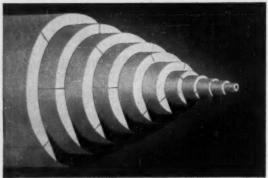
Kaylo is made both as block and as molded pipe insulation with the widest range of sizes, forms and thicknesses of any high-temperature insulation. Now distributed by Owens-Corning Fiberglas Corporation, it provides, together with Fiberglas* Industrial Insulations, the most complete and versatile line of plant insulations available. For complete technical data, see our listings in Sweet's File, Chemical Engineering Catalog, or Refinery Catalog, or write: Owens-Corning Fiberglas Corporation, Dept. 97-D, Toledo 1, Ohio.

Kaylo and Fibergias* now provide you with all-purpose industrial insulations from one reliable supplier.



T. M. Reg. Owens-Corning Fibergias Corporation
® Mfd. by Kaylo Div., Owens-Illinois Glass Co., Inc.

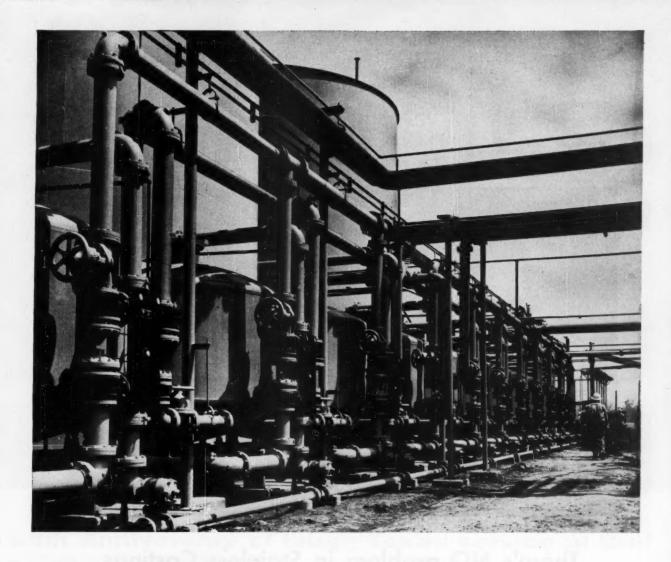




Snug nesting where necessary. O. D.'s of Kaylo insulation correspond to O. D.'s of standard pipes from ½" to 24", assuring proper fit and nesting where necessary.



Easily cut with ordinary tools. Kaylo is light-weight and so workable that it can be removed and replaced for line inspections without waste.



TITANIUM ... your solution to corrosion problems

Titanium can eliminate many of your most serious corrosion problems, for it is exceptionally resistant to most forms of corrosive attack. Titanium, for example, is almost entirely inert to the chloride ion. Corrosion rates from nil to 0.15 mils per year are reported for titanium immersed in hot and boiling solutions of cupric and ferric chloride, and sodium and calcium hypochlorite.

But titanium's remarkable qualities do not stop there. It is as strong as steel, but 44% lighter . . . and can be worked by standard shop practice.

In valve trim, drums, heat exchangers, condensers, for example, titanium pays its way in less idle equipment time . . . lower replacement costs . . . less product contamination.

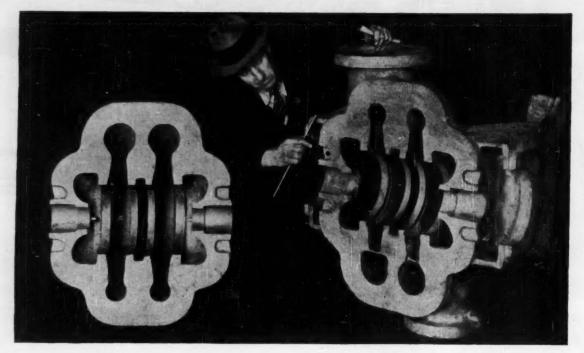
REM-CRU's engineers will be glad to help you make the best use of this unique metal in your plant. And it can be done *fast*, for REM-CRU's expanded facilities mean prompt delivery of REM-CRU titanium in the forms and grades you need.

To keep abreast of the latest developments on this vital metal, write to Dept. C4 for the Rem-Cru Review—a free periodical presenting the latest technical data on titanium alloys.

REM-CRU TITANIUM

REM-CRU TITANIUM, INC., MIDLAND, PENNSYLVANIA





There's <u>NO</u> problem in Stainless Castings that we can't answer for you—



Write for your copy: "ALLEGHENY METAL CASTINGS"

32 pages of valuable and complete data on stainless castings: analyses, properties, technical data on handling and heat treatment, typical applications, how to order, etc.

ADDRESS DEPT. CE-64

Odd shapes or intricate sections are certainly no problem—look at some of our Allegheny Metal casting products illustrated above. We could show you hundreds more. And size is no consideration, either—we're equipped to handle any stainless castings—from a few ounces to thousands of pounds.

The really important point for you to consider is not the matter of shape or size, but of experience. The AL Buffalo Foundry is a group of specialists in high-alloy steel castings exclu-

sively... pioneers in both the static and vertical-centrifugal methods of casting stainless steels.

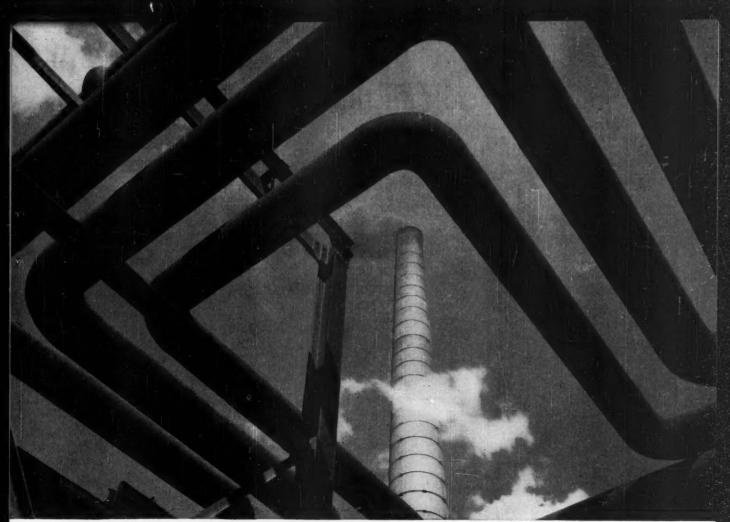
For your assurance, there's a long record of years of successfully answering difficult service conditions with sound, clean-grained Allegheny Metal castings—free from defects, easy to machine and dependable in supply.

• Let us quote on your stainless casting requirements. Allegheny Ludlum Steel Corporation, Henry W. Oliver Building, Pittsburgh 22, Pennsylvania.

You can make it BETTER with Allegheny Metal

wap noon Warehouse stocks carried by all Ryerson Steel plants





"Worm's eye" view of live and exhaust steam lines protected with Carey insulation at Gulf's Port Arthur, Texas refinery,

25th Anniversary of tough Texas service at Gulf

... Carey Magnesia Insulations defy vibration, humidity, heat!

Continuous outdoor service for 25 years! That's the record set by Carey magnesia insulation at Gulf Oil Corporation's big refinery, Port Arthur, Texas. And here, service conditions are really rugged. Besides the unmerciful vibration, expansion and contraction present in every refinery operation, you have blazing sun, high winds, heavy rains and corrosive salt air!

Carey's experience in development and manufacture of insulation products since 1873 is *one* big reason why Carey insulations are so outstanding. And it's the reason, too, why we believe we can help you solve your heat insulation problems, unusual though they may be.

The Carey line includes insulation for sub-zero to 2500°F service. Major products are Super-Light 85% Magnesia and Tempchek in precision-sized blocks and nesting "O. D." pipe coverings; blankets; pipe wrapping and jackets; cements. All excel in ease of application; are economical to use. Ask your Carey Industrial Sales Engineer for helpful advice.

Quality Products for Industry, Farm and Home Since 1873 Write for your free copy of catalog giving complete technical and application data. Address Dept. CE4.



Carey

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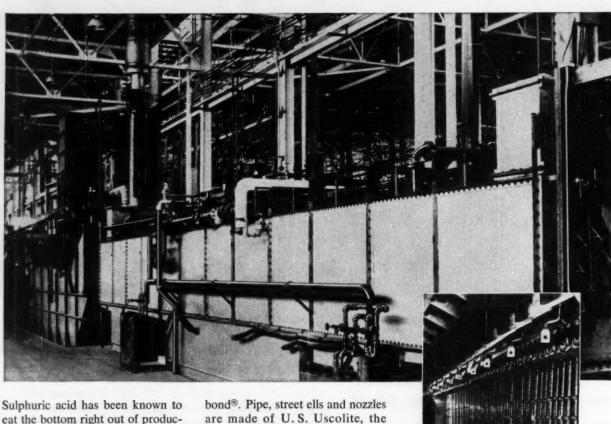
THE PHILIP CAREY MFG. COMPANY
Lockland, Cincinnati 15, Ohio

In Canada: The Philip Carey Co., Ltd., Montreal 3, P. Q.

Carey-approved contract units in major trading areas. Consult your nearest Carey District Office or your telephone directory.

Sulphuric acid tamed... when it flows through low-cost

U. S. Rubber Linings and Pipe



Sulphuric acid has been known to eat the bottom right out of production economies. But this large Midwestern plant is one of many that has found the economic way of handling this highly corrosive acid. They use United States Rubber Company Linings and Uscolite® plastic pipe and fittings.

The pickling machine in this plant handles a 10% to 15% solution of sulphuric acid. The process tank, pipe and pipe headers, and internal surfaces of housings and plates are lined with U. S. Permo-

bond[®]. Pipe, street ells and nozzles are made of U.S. Uscolite, the thermoplastic that resists corrosive acids.

Both Permobond and Uscolite are extremely versatile. Permobond can be bonded or applied to any fabricated metal section, no matter how big or complex. Uscolite piping is amazingly strong, yet lightweight and easy to handle. Both of these "U. S." products provide savings not only in operating costs, but in maintenance as well. Call on any of the 27 "U. S." District Sales Offices, or write to address below.





"U.S." Research perfects it . . . "U.S." Production builds it . . . U.S. Industry depends on it.

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Yes, it's true!

Industry everywhere is checking into the facts about these amazing new Totally Protected A-c. Motors by Reliance.

To help you check the facts to see where it fits into your production area, we've prepared a booklet called "Check the Facts".

Get your copy today-by mail, or through your local Reliance district sales office or distributor.

CHECK THE FACTS

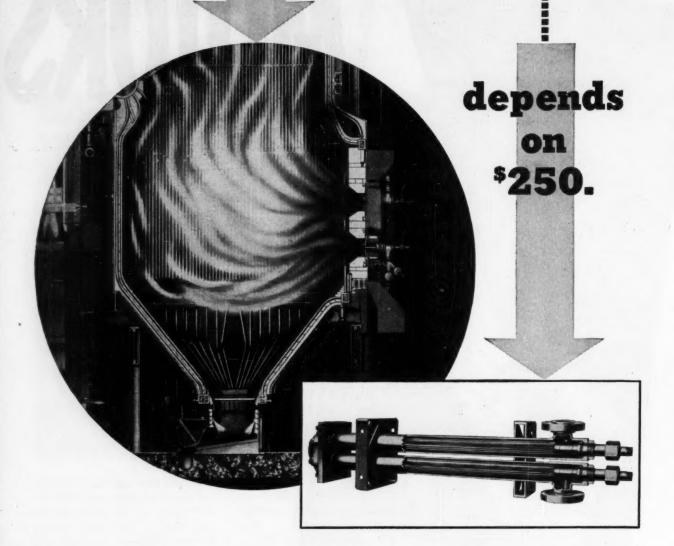


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Many large-capacity high-pressure oil-burning boilers cost as much as a quarter of a million dollars; while the little fuel oil heaters that serve them cost only a few hundred dollars. But these huge boilers can deliver the desired steam only if the little heaters maintain rated capacity and preheat the fuel oil sufficiently to assure free flow.

G-R Fuel Oil Heaters will give your boilers . . .

and you . . . this assurance. Their reliable ratings are based on the G-R 85 years of experience in heat transfer. Their simple design and their sturdy construction, conforming to API-ASME codes, assure dependable operation. They are easy to clean and economical to maintain.

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A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION



Fuel Oil Heater



GR-325

neW Limitorque economy...

greater valve stem capacity

withstands greater thrust LIMITORQUE Q PRILAMELPRIA CLAR WANT PRILAMELPRIA PH

compact and simple

gives

more torque

features

Two piece stem nut design permits changing unit from one valve to another. Torque control for both directions of stem travel or single direction as required. Easier handwheel operation.

Improved switch design and electrical arrangement. Either torque or geared limit con-

trol operation. Easier declutching.

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gear drives

most economical and dependable operator for all small valves.

Do you have need for a small, low cost automatic valve operator that will give you rapid operation control of your valves? If so, the SMA-00 and SMA-000 is the answer. They are readily adaptable to all types of valves, including gate, plug, globe and butterfly.

Size for size these units are designed for greater valve stem capacity, will produce more stem torque, and will withstand greater thrust than any other valve operator on the market. Also, should a power failure occur, LimiTorque can be operated by the hand wheel.

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First-rate fire protection is essential to the continued success of any business. With C-O-TWO Smoke or Heat Fire Detecting Systems, plus C-O-TWO High Pressure or Low Pressure Carbon Dioxide Type Fire Extinguishing Systems, as well as PYRENE Air Foam Type Fire Extinguishing Systems for specific outdoor locations, your plant can have fast, positive round-the-clock fire watchman service simultaneously at each fire hazard point . . . a fire tragedy-is stopped before it starts.

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Standard Equipment
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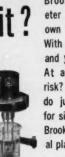
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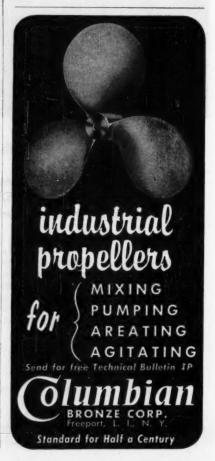
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It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

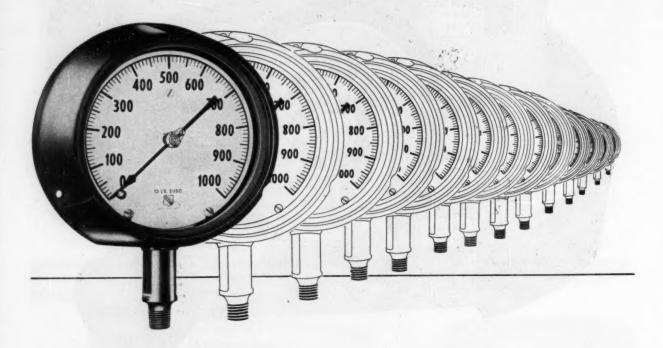
Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH

ENGINEERING COMPANY
313 WILSON, SO. NORWALK, CONN.

SATISFACTION MULTIPLIED $3 \times 8 \times 8 \times 38 \times 2 \times 5$



Service Conditions primarily determine the pressure gauge you specify for your installation. The wrong gauge can cost time, trouble, and money.

That's the big reason why Ashcroft Duragauges make sure of your complete satisfaction by offering a multiple choice in case designs and materials, Bourdon tube materials, ranges, movements, and dial sizes. Briefly, you can select the right gauge for your requirements from:

Cases of 3 different materials in 8 serviceproved designs. **Bourdon Tubes** of 8 different types of metals to meet specific service requirements.

Pressure Ranges from 30" vacuum or a few ounces through 100,000 psi.

Rotary Geared Movements that include the famous "Nylon Movement" or all stainless steel.

Dial Sizes from 4½" through 12".

Most important, Ashcroft Duragauges provide that unbeatable combination of highest sustained accuracy and durability of any pressure gauge built.



TAKE ADVANTAGE of the counsel of your nearby Industrial Supply Distributor. You can count on him to help you select Ashcroft Duragauges that will serve better and longer, with minimum maintenance, no matter how severe the conditions of vibration, pulsation, corrosion and weather.

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MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, Stratford, Conn. 'HANCOCK' VALVES, Watertown, Mass. 'CONSOLIDATED' SAFETY RELIEF VALVES, Tulsa, Oklahoma. AIRCRAFT CONTROL PRODUCTS, Danbury & Stratford, Conn. and Inglewood, Calif. "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, Muskegan, Mich.

Planning to Retube a Butane

The opportunity to boost heat duty of butane condensers—without the expense of investing in new equipment—is available to processing engineers right now!

8

The secret? Retube with Wolverine Trufin* Type S/T—the only integral finned condenser tube for shell and tube heat exchangers.

By replacing prime surface tube with Trufin Type S/T, you can obtain as much as $2\frac{1}{2}$ times greater shell side surface area in existing equipment. Result: increased heat duty from present units.

Trufin Type S/T is mechanically interchangeable with plain tube of the same size. It can be rolled or brazed into headers by conventional methods. All the mechanical features of conventional types of heat exchangers as well as the custom designs of individual fabricators can be retained.

*REGISTERED U.S. PATENT OFFICE

Condenser?

Trufin in copper, copper-base alloys, aluminum and electric-welded steel is furnished in a wide range of sizes. It's available with four different kinds of end finishing: both ends finned, both plain, both stripped, or one end plain and the other stripped.

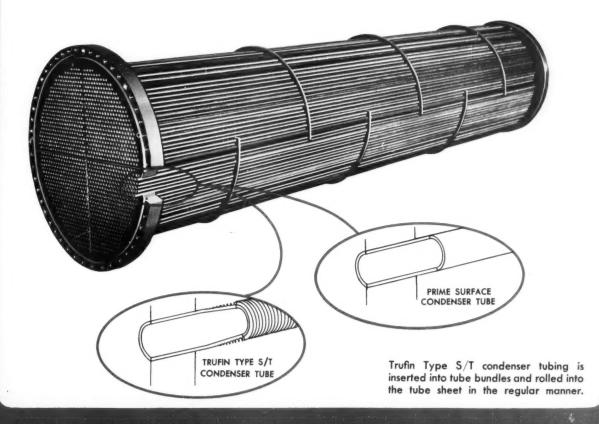
You'll save if you specify Trufin when retubing is necessary. Call Wolverine right now! And write for a copy of Wolverine's new Opportunity Book. It's proof positive.



WOLVERINE TUBE

DIVISION OF CALUMET & HECLA, INC.

Manufacturers of Quality Controlled Jubing and Extruded Aluminum Shapes



A Condenser Tube for Every Job

PRIME SURFACE



Wolverine keeps in step with processors' demands—not only with Trufin Type S/T, but with additional types of condenser tubing. From this complete line you can specify exactly the tube you need to meet your particular demands. Into each of these products goes all the research, the engineering skill and Tubemanship, that has made Wolverine a leader for more than 38 years. Your tubing dollars develop real stretchability!

TRUFIN TYPE L/C



PRIME SURFACE TUBE

Wolverine manufactures prime surface tubing in three metals—copper, copperbase alloys, aluminum and electric-welded steel—all quality controlled.

Duplex PRIME SURFACE TUBE

Here's a tube designed to handle two types of corrosive attack simultaneously. It is composed of a tube of one metal and a liner of another. The combination can be any alloy you need to meet special conditions.

U-BEND PALLETS





Duplex TYPE S/T

This tube also is designed for specific corrosive conditions. But, like Trufin, it has integral fins—will boost heat transfer efficiency. It can be used instead of prime surface tube.



TRUFIN TYPE L/C

A high-finned, lightweight aluminum tube is mechanically bonded to an interior liner of the alloy which best beats your corrosion hazard. It provides maximum heat transfer and trouble-free performance at low cost.

FIELD ENGINEERING SERVICE

DUPLEX TYPE S/T



U-BEND PALLETS

This new Wolverine idea cuts time, reduces storage problems, and saves money. U-bend condenser tubes—either finned or prime surface—are arranged in a disposable box-type pallet in the exact order you specify. All you have to do is feed them directly from pallet to unit.

FIELD ENGINEERING SERVICE

This is a Wolverine "extra"—a staff of highly-skilled tubing technicians. You can get experienced help in solving problems dealing with alloys, corrosion, design or fabrication. You'll find complete information in Wolverine's Condenser Tube Catalog. Send for your copy now. Wolverine Tube, 1443 Central Avenue, Detroit 9, Michigan.





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DIVISION OF CALUMET & HECLA, INC.

Manufacturers of Quality-Controlled Jubing and Extruded Aluminum Shapes

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario.

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

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Here's the lightweight, stainless steel acid container that builds a safe, compact stack—saves warehouse space and handling time for you. Bottom foot ring of the 15½-gallon Hackney Chemical Container fits snugly over top ring of lower barrel.

Designed with easy-to-grasp, full curled foot rings for safe, one-man handling and convenient pouring. Your name can be embossed on the bottom foot ring. Low tare weight reduces transportation costs. Stainless Steel protects your dangerous or perishable chemical products—eliminates breakage losses.

Write today for the Hackney Drum and Barrel Catalog.

Pressed Steel Tank Company

Manufacturer of Hackney Products

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CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

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What a big difference in comfort the HINGED BRIDGE makes!

Your workers will say they never had comfort like they get in the new Willson Contour-Spec—and its new hinged bridge adds an extra measure of protection, too!



It's the *hinge* that permits equal pressure at every point of contact with the face ... snug comfort regardless of facial contour! And it's the hinged bridge that means extra safety because there are no dangerous gaps around the eyes.

Contour-Specs conform to any face—heavy, lean, round, long or bony! Result is, a new concept of comfort combined

with protection that encourages workers to wear them willingly.

Let them try Contour-Specs—see how well the 47-mm. lenses suit every eye size—feel how easily the light-weight, snug-fitting Butyrate plastic frame "sits" without pressure anywhere. Order a supply from your Willson distributor now.

NEW Contour-Spec *
SAFETY SPECTACLES BY .



Leaders in Research and Development of Safety Equipment Since 1870 106 THORN ST., READING, PA.



How to keep
informed on
the "with what"
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your business

AT YOUR FINGER TIPS, issue after issue, is one of your richest veins of job information—advertising. You might call it the "with what" type—which dovetails the "how" of the editorial pages. Easy to read, talking your language, geared specifically to the betterment of your business, this is the kind of practical data which may well help you do a job quicker, better—save your company money.

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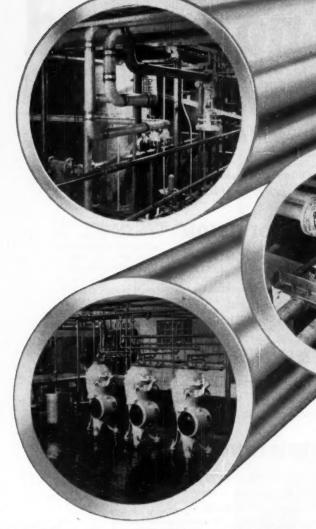
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McGRAW-HILL PUBLICATIONS



when you need

STAINLESS PIPE...



look at all

SCHED. 10
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To get the most economical stainless pipe for handling corrosive fluids, Schedules 5, 10, and 40 should be closely compared for:

initial cost
installed cost
ease of handling
flexibility of assembly
flow capacity
adequate allowable working pressure
effective corrosion resistance
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Whichever Schedule—5, 10 or 40—is best for your service conditions, Carpenter makes it to meet ASTM pipe specifications. Carpenter Stainless Pipe is available in sizes up to 4 inches, depending on weight... in AISI stainless analyses plus Carpenter Stainless No. 20 Cb, and Carpenter Alloys B and C for super corrosion resistance. For services requiring extra smooth surfaces, Carpenter Stainless Pipe can be supplied with 80 to 320-grit polished I.D. and/or O.D. finishes. Adequate stocks are as close as your local distributor. Call him for information and time-saving delivery.

Here's A Cost Comparison on All Three

SCHED. 10
SCHED. 40

Here's How All Three Compare in Weight



Stainless Tubing & Pipe

meet the family of

Hoffman Engineered Industrial Products

Each year more and more of the nation's industries place their confidence in products engineered and manufactured by U.S. Hoffman.

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Centrifugal Blowers and Exhausters
Pneumatic Conveying Equipment
Industrial Vacuum Cleaning Systems
Continuous Metal Strip Driers
"Smoothflow" Tubular Pipe and Fittings

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Machine Tool Coolant Clarifiers—Flotation, Mechanical and Magnetic Lubricating and Insulating Oil Conditioners, Filters and Vaporizers Solvent Recovery Systems—Vacuum Stills and Filters

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Mechanized Metal Cleaning and Phosphatizing Systems
Chemical Plating Equipment
Electrostatic Spray Painting Equipment
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Filters for Phosphate and Plating Solutions
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Pneumatic Conveying Systems
High Efficiency Centrifugal Separators
Stationary and Portable Vacuum Cleaning Equipment
Process Equipment
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Keep your eye on the forward march at Hoffman. Let us make your problems our responsibility.

INDUSTRIAL DIVISIONS

U.S. HOFFMAN MACHINERY CORPORATION

DEPT. CN 105 FOURTH AVENUE, NEW YORK 3, N. Y.



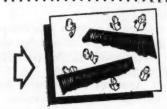
All business is specialized

...and nothing specializes
on your business like your
business paper

This profit-wise peddler looks for the wettest crowds. His business is specialized. Like yours.

And like your business, this business paper of yours specializes, too. It packs into one place the current facts you want. It scouts out, sorts out, reports and interprets the specific news and information you need to keep posted and keep ahead in your field. Cover to cover, editorials and ads, it concentrates on bringing you specialized help you can't get anywhere else. Read it thoroughly . . . and put it to work.

This business paper in your hand has a plus for you, because it's a member of the Associated Business Publications. It's a paid circulation paper that must earn its readership by its quality... And it's one of a leadership group of business papers that work together to add new values, new usefulness, new ways to make the time you give to your business paper still more profitable time.



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McGRAW-HILL PUBLISHING COMPANY 330 W. 42nd St., New York 36, N. Y.

One of a series of ads prepared by
THE ASSOCIATED BUSINESS PUBLICATIONS



Designed for

SPECIAL PROCESS
DIFFICULT SEPARATION

This column with its many trays provides an excellent example of our combined design and manufacturing facilities. Our equipment design talents come from experience with processes of many kinds in both the organic and inorganic fields. Our fabrication experience includes the use of all commercially used metals.

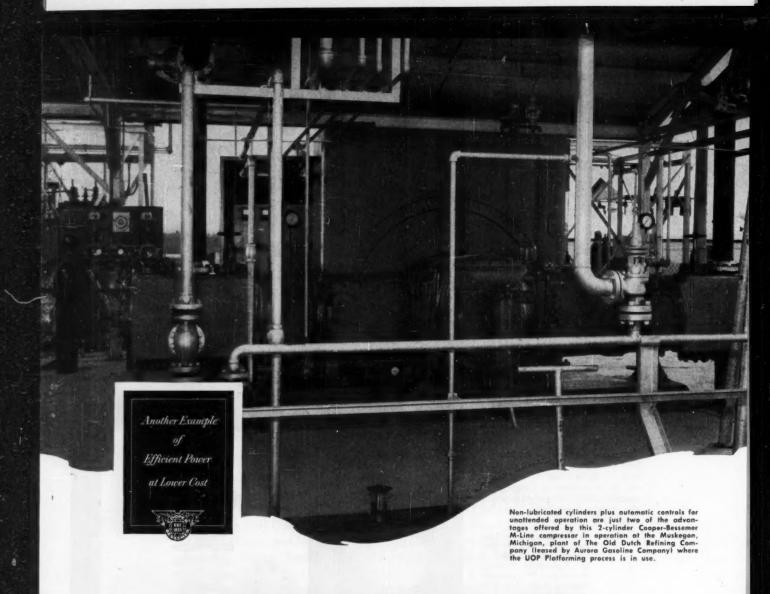
If you have a problem in equip-

ment design, we'll be glad to help. If you want equipment of your own design fabricated by skilled craftsmen to exacting standards, here is where you will get that combination. May we have your inquiry?

SPECIAL NOTE: The expansion joint shown just above the tray detail, lower right, is a 36" Badger Double Hinged Type Expansion Joint for a turbine crossover connection.

BADGER MANUFACTURING COMPANY

230 BENT STREET, CAMBRIDGE 41, MASS., 60 EAST 42nd STREET, NEW YORK 17, N. Y.



"HYDROGEN COMPRESSES CLEAN" ... with Cooper-Bessemer's non-lubricated cylinders

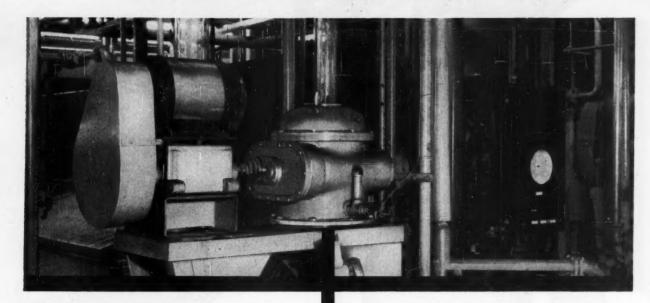
RECYCLING millions of cubic feet of hydrogen a day for the UOP Platforming of low-octane gasoline, demands continuing efficiency from a smooth working compressor that will not contaminate the recycle hydrogen. That is one of the reasons why The Old Dutch Refining Company, leased by Aurora Gasoline Company, recently installed a 2-cyclinder Cooper-Bessemer FM compressor in their modern plant in Muskegon, Michigan.

To avoid contaminating hydrogen with oil in the recycle gas, Cooper-Bessemer successfully developed a non-lubricated compressor cylinder.

Operating against micro-smooth hardened cylinder liners, these 8" diameter carbon pistons require no lubrication whatever. With a mirror finish, the cylinder bores reveal no excessive wear. No matter how exacting or complex your compressor problems, check the advantages offered by Cooper-Bessemer M-Line compressors. For dependability and money-saving operation, you can rely on Cooper-Bessemer — one of America's oldest engine builders offering the latest in engineering advancements.

COOPER-BESSEMER
GROVE CITY, PENNA.

New York City * Seattle, Wash. * Bradford, Pa. * Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. * Shreveport, La. * San Francisco, Los Angeles, Calif. * St. Louis, Mo. * Gloucester, Mass. * New Orleans, Lo. * Tulsa, Okla. * Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia.



Take this Nettco Model T-27 Drive, for example. It is an engineered combination of Nettco experience and Nettco equipment—and because it's RIGHT for the job, this agitator speeds processing, reduces operating and power costs, and minimizes maintenance.

Nettco Model T Drives explain, in part, why Nettco can supply the right agitator for every job. There are five basic Model T Drives, supplied in any one of 35 easily changed ratios. This flexibility of equipment, coupled with Nettco's agitation research and experience in over 50 years of serving the process industries, is your continuing guarantee of the best in agitation from Nettco.



Catalog No. 530, describes the complete line of Nettco tank top, side entering, and pipe line mixers and Nettco agitator accessories. Bulletin No. 532, a detailed review of the Nettco line of side-entering mixers for storage tank mixing. Bulletin No. 531, describes the Nettco Flomix®—a patented and unique pipe line mixer for continuous processing applications.

May we help you get the *right* agitator for your job? Send for catalogs or engineered recommendations, to New England Tank & Tower Company, 87 Tileston Street, Everett 49, Mass.

FOR EVERY JOB THERE'S ONLY ONE AGITATOR THAT'S

RIGHT!







NEW STANOLITH GREASE

A new grease! White and clean in appearance, STANOLITH Grease White is the perfect grease for use in food and beverage plants. Specially recommended for bakeries, breweries, candy factories, canning and cereal plants, chemical processing plants, dairies, distilleries, meat processors—all industries where clean, sanitary operating conditions are at a premium.

• STANOLITH Grease White is a new high quality, multi-purpose lithium soap grease with a clean, white color. It assures you of unmatched lubricating cleanliness plus unmatched lubricating efficiency.

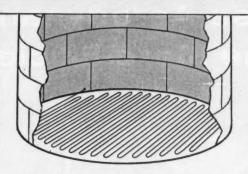
In addition to the high-temperature and water resistant properties, characteristic of most lithium greases, Stanolith Grease White has superior mechanical and chemical stability. It provides a water-resistant lubricating film that gives this remarkable grease extended multi-purpose usage in a wide variety of applications. Easily handled in all usual types of grease-dispensing equipment, it is safe, easy-to-use, clean. Call your nearby Standard Oil lubrication specialist for full details on new Stanolith Grease White.

STANDARD OIL COMPANY (Indiana)

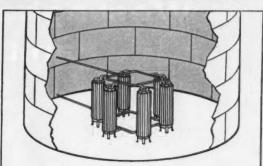


BROWN FINTUBE'S

BETTER DESIGN MEANS BETTER PERFORMANCE



• Old-fashioned coils on the bottom of the tank are expensive to install. The pipes are soon covered over with sediment which seriously restricts the transfer of heat from the pipes to the tank liquid. The tank bottom is cluttered and difficult to clean.



 Our TF-18 Tank Heaters mount vertically. Sediment can not settle on the heat transfer surfaces. Heaters are entirely surrounded by tank liquid, assuring highly efficient heating of stored products year after year. Tank bottom is uncluttered, easy to clean.

Vertical Mounting

of BROWN FINTUBE TF-18 TANK HEATERS assures more efficient, less costly heating of stored products

Our TF-18 vertically mounted tank heaters have obsoleted old-fashioned tank coils — and give users four outstanding advantages:—

1) Lower Cost—Users report that the cost of our TF-18 Heaters plus their installation is usually less than the cost of just installing bare pipe coils of equivalent capacity.

2) Vertical Mounting — on legs about 10" above the tank floor brings the entire heating surface in contact with the stored product — avoids heating through a layer of sediment.

3) Increased Heating Efficiency — the finned construction provides about 7 times more heating surface per foot of lineal length than plain bare pipe. This permits more heat to be transferred — faster — at lower temperatures per square foot

of surface, avoiding coking or damage to heat sensitive products. Mild steel or alloy construction.

4) Easy Installation — TF-18 Heaters pass through a standard manhole permitting easy installation in new or existing tanks. Can be flange connected when desired and thus do not require welding inside the tank. Individually trapped, or manifolded inside or outside the tank.

You can't keep your operations competitive with old-fashioned, obsolete methods. Write today for Bulletin 541. It gives full details, dimensions,

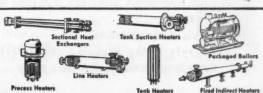
etc., about our fully proved, less costly TF-18 Heaters. Tested, and widely used by many of the best known, most progressive, lowest cost companies in the industry. Write for Bul. No. 541 today!





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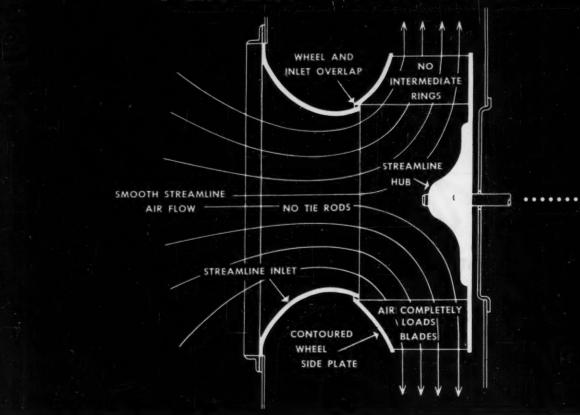
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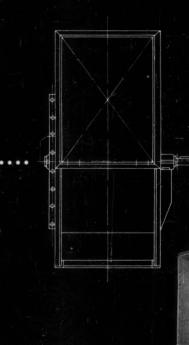
With unobstructed airflow through the wheel in all sizes, the "Silentvane" fan line also offers these other practical advantages:

- 1. True self-limiting horsepower characteristic
- 2. Peak horsepower developed in normal selection range
- 3. Quiet, stable operation
- 4. Sharply rising pressure characteristic throughout normal performance range

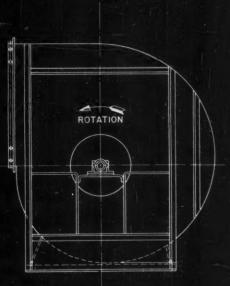
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Handling from 600 to 500,000 cfm, the performance-proved Westinghouse "Silentvane" fan line provides an almost unlimited choice of air moving equipment. Coupled with Westinghouse-Sturtevant power-saving Vane Control, "Silentvane" fans offer precise control of air volume at optimum efficiencies. In smaller sizes, 36" and under, fan arrangements are convertible.

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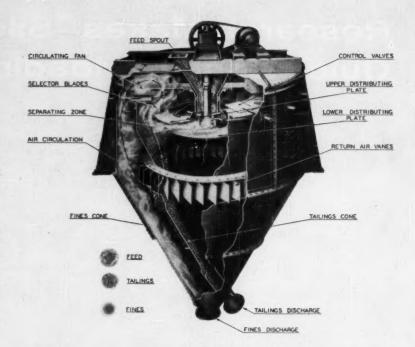
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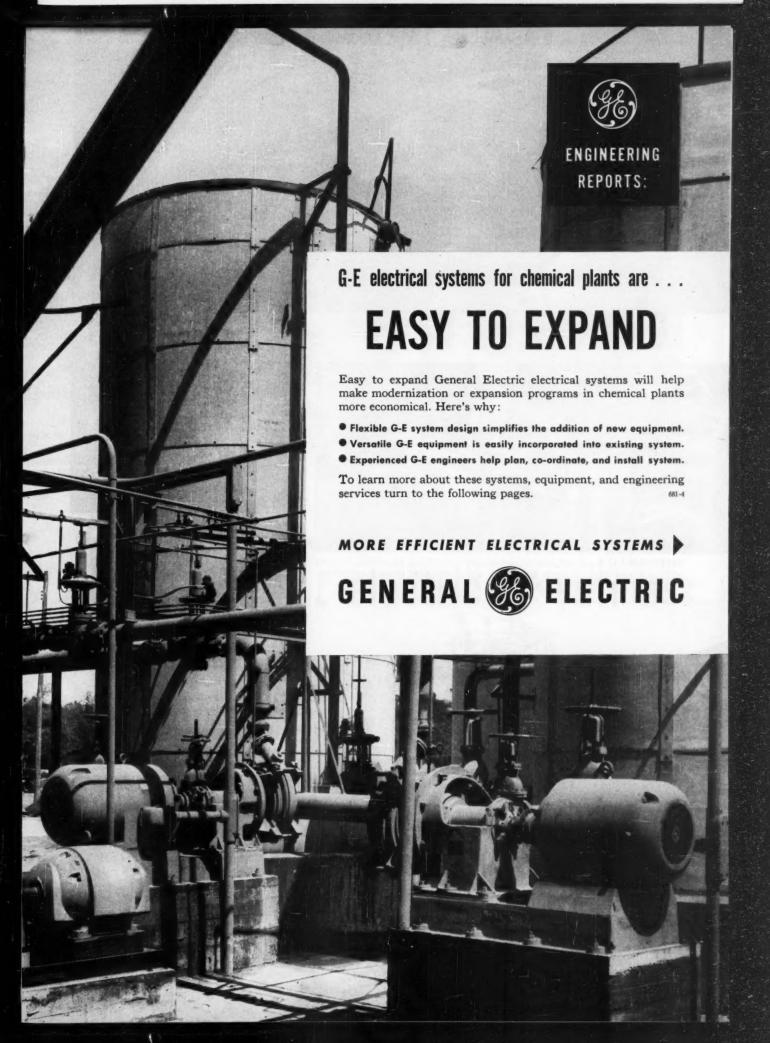


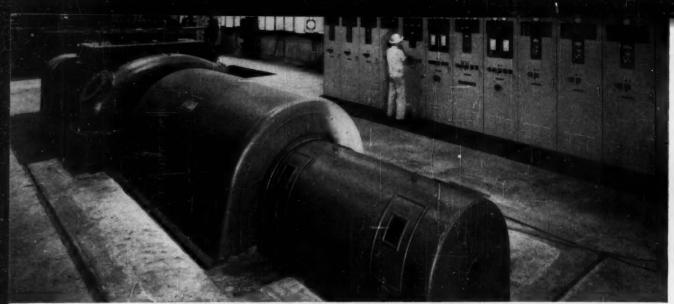
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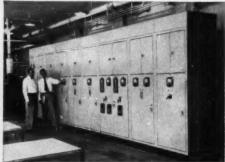
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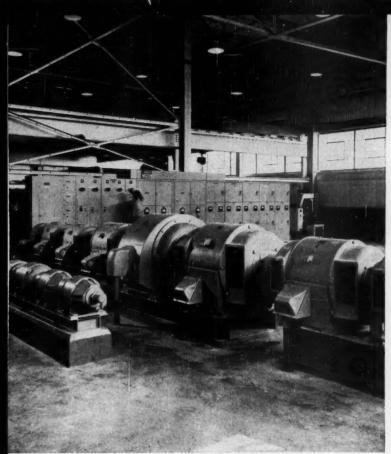
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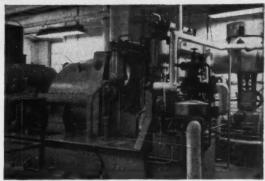
COMPLETE, COMPACT, G-E motor control centers provide centralized control in load areas



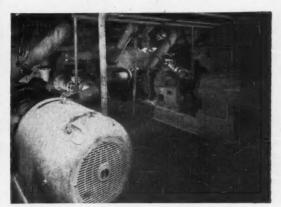
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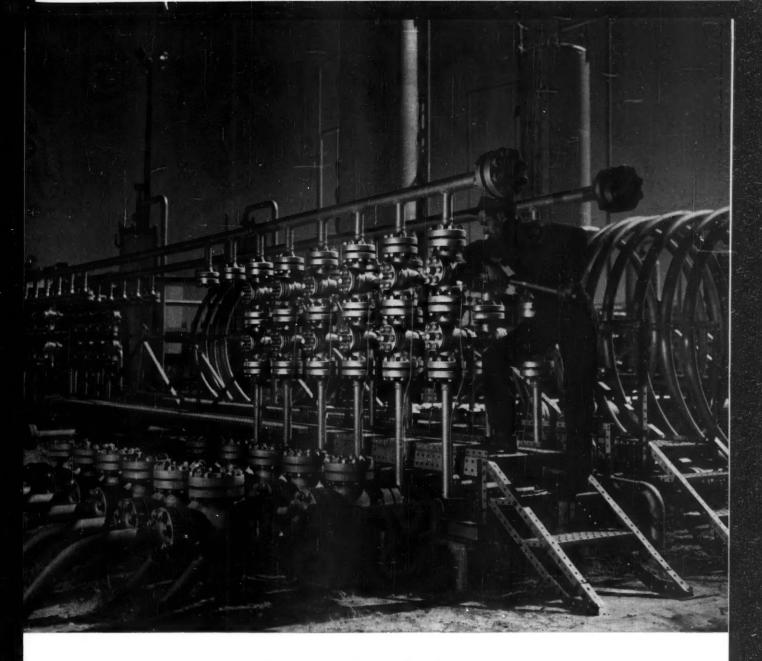
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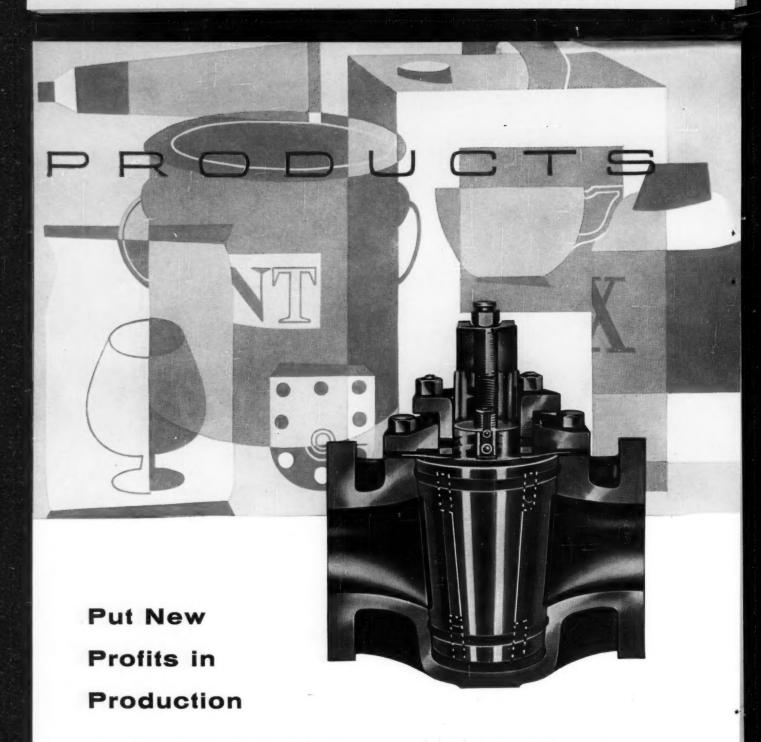
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constantly renewed seat for leak proof sealing; 3. allows the plug to be hydraulically jacked for instant operation when necessary.

Today's Rockwell-Nordstrom quality is the result of forty years of leadership in building the most complete line of lubricated plug valves and plug valve lubricants in the world. Why not use that unequaled experience to cut *your* valving costs! Rockwell Manufacturing Company, Pittsburgh 8, Pa.

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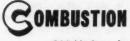


The Company's Nuclear Power Division is undergoing continuous expansion, and opportunities for advancement are commensurate with the large role the Company is planning to play in the design and manufacture of complete nuclear power plants up to the turbine.

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P. 5582.

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To provide for its continued growth Chemical Week is seeking two additional assistant editors—preferably chemists or chemical engineers with two to three years business experience. Essential: Ability to meet people, dig out facts, interpret them intelligently and write lucidly. Please submit resume to:

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	American	70	ELS	4214	25%
	American	55	ELS	361/4	23
	Sturtevant	50	Des. 3	36	19
	New York	33	GI	33	21 %
	Buffalo	45	MW	32	19 35
	American	50	ELS	31	18 /2
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	American	35	E	23	10
	Sturtevant	30	Des. 2	18	11
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- 3-Patterson & Abbe 4'6" dia. x 12 cont. Pebble Mills
- 2-Charlotte Colloid Mills, model #50, 75 HP motor
- 1-Bird solid bowl Centrifuge 36" x 50"
- 8-Muffle Furnaces chrome nickel alloy tubes 24" x 8'6" long
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THE GELB GIRL-APRIL 1955

- -Fletcher Stainless Steel Suspended Type Centrifuge, 40" Perforated Bas-
- -A. T. & M. Stainless Steel Susp. Centrifuges, 48" Imperiorated Basket. -Sharples Type 316 S.S. Super-D Hy-
- drator, Model No. C-20.

- DRYERS—KILNS

 Buflovak 24" x 36" Double Drum Dryer.

 Buflovak 24" x 5' Dryer.
- -3' x 12' Stainless Steel Rotary Vacuum
- -Steel and Alloy 3' x 15' Heresite-lined
- Rotary Vacuum Dryer. Stokes Rotary Vacuum Dryer, 30" x 8'. Buflovak 32' x 90" Double Drum
- Dryer-Complete.

Allis Chalmers 28" x 60" Double Drum Dryer. CONDENSERS, HEAT

- **EXCHANGERS & COLUMNS** -Lummus Stainless Steel Heat Ex-
- changer, 360 sq. ft. Struther Wells, Hastelloy "B" Heat
- Exchanger 480 sq. ft. Colonial Monel 338 sq. ft. Condenser, Shell 50 PSI Tubes 100 PSI ASME.
- Badger 5' dia. x 23' Copper Column,
- 20 bubble cap trays (New). -Hatfield Stainless Steel Bubble Cap Column, 6' x 16'6", 7 trays.
- Alco Steel Heat Exchangers, 360 sq. ft. each.
- -Downington Stainless Steel Condensers, 500 sq. ft. each.

FILTERS

- 10-Shriver & Sperry Plate and Frame Filter Presses from 12" to 42".
- Sweetland #2 Stainless Steel Filter. Sperry Filter Press Skeleton, 42", with
- hydrostatic closing device (New). Shriver Cast Iron 24" x 24", Closed De-livery Filter Press, 20 chambers.
- Sperry Wooden Plate and Frame Filter Press, 12" x 12", 15 chambers.

- -Pfaudier 50 gal. Glass Lined Jocketed Vacuum Reactors Type E5 with Anchor type aglitators. Jacket 75 psi.-Pfaudier 10,000 galion horizontai Acid Glass-lined Storage Tanks, 10½'dia. x 14' straight side (New).-Pfaudier 50 galion Glass-lined Vacuum Reactors (New).-Nooter 1,000 galion Type 316 Stainless Steel Jacketed Reactor, 50 PSI Internal, 110 PSI Jacket (New).-Fletcher 20" Stainless Steel Centrifuges with perforated baskets.-Feinc Type 316 Stainless Steel Filters, 6'6" x 6' (New).

- 1—Sparkler Stainless Steel Filter Model 19512 on Portable Unit.

MIXERS

- -International, Stainless Steel Ribbon Mixer 50 cu. ft. w/drive.
- Simpson Intensive Mixers #0 and #1. Baker-Perkins Double Arm Jacketed Sigma Blade Mixers, 100 gal. ca-
- pacity.
 Read 10 gallon Stainless Steel Double
- Arm Sigma Blade Jacketed Mixer, with vacuum cover. -Day Double Arm Sigma Blade Jacketed
- Mixer, 75 gallon.
- Day Stainless Steel Double Arm Jack-
- eted Sigma Blade Mixer, 50 gal.

 Struthers Wells Double Arm "North-master" Mixer, 50 Gals. Working Cap., 100 Gals. Total Cap.
- Lancaster, Stainless Steel Muller Mixer Model LW w/motor.
- -Robinson 17.5 cu. ft. Jacketed Steel Ribbon Powder Mixer.

PULVERIZERS--GRINDERS -MILLS

- -Eppenbach QV-8 Stainless Steel Colloid Mill with motor.
- Abbe #00 Rotary Cutter with 3 HP Motor.
- Mikro #2TH Stainless Steel Pulverizer.
- -Mikro #3TH Mikro Pulverizer with 30 HP Motor.
- 1-Mikro #3W Pulveriser.

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DEPENDABLE EQUIPMENT FROM LOEB-

AGITATORS

-Aisop 5 hp. explo. proof, 420 RPM.
-Aisop 3 hp. explo. proof, 420 RPM.
-Aisop 2 hp. explo. proof, 420 RPM.
-Aisop 1 hp. explo. proof, 420 RPM.
-International 1 hp., 1725 RPM.
-Porter 1 hp., 420 RPM.
-Lightnin ¾ hp., 1725 RPM., TEFC.
-Lightnin ½ hp., 430 RPM., TEFC.
-Lightnin 2 hp., 1140 RPM., TEFC.

CENTRIFUGALS & CLARIFIERS

DeLaval 84-51, 3 hp. motors.
DeLaval SVK54 with 10 hp. motor.
DeLaval 84-21 with 5 hp. motor.
Tolhurst 32" susp., rubber covered.
Tolhurst 18" suspended, st. steel.

1—Forter Devine 2 x 4 vac. drum, 316 s.s.
2—8 x 50' Lacy direct heat.
1—Buffalo Vacuum Shelf, 5 42 x 42"
shelves.
1—7' x 80' direct heat.
1—3' x 24' Hardinge direct heat.

FILTERS

Oliver 2½ x 1', iron and steel.

Denver 1 x 3' vacuum rotary.

1—Oliver 3 x 4' phosphur bronze.

1—Oliver 8 x 14' iron and wood.

1—Fainc 10'6'' x 16'.

12—Filter Presses: cast iron, alum., wood, from 7'' to 30''.

7—Internal Pressure—Alsop, Sparkler.

1—Devine 1500 gal. jack., agit. 15—St. Steel jacketed, 20 to 100 gal. 4—St. steel agitated Cookers.

MILLS & PULVERIZERS

MILLS & PULVERIZERS
Pebble: Abbe porc. lined, 215 gal.
Homoloid: Fitspatrick mod. J, 3 hp.
3-roll Day 12 x 32, 18 x 40".
Hammer: William BX, 60 hp.
Hammer: William BX, 60 hp.
Hammer: Raymond 16", 7½ hp.
Hammer: Raymond 16", 7½ hp.
Pulveriser: Micro 2DH, 10 hp. (New).
Pulveriser: Micro 2TH, 15 hp.
Hammer: Gump Bar-Nun, 20 hp.
Pebble: Patterson buhr. lined, 220 gal.
Pebble: Patterson buhr. lined, 220 gal.
Pebble: Raymond #40, 50 hp.
Colloid: Charlotte 10, st. st., 3 hp.
Colloid: Premier 3" s. st., 7½ hp.
Colloid: Premier 3" s. st., 7½ hp.
Colloid: Premier U-3, 7½ hp.

4—Baker-Perkins 100 gal. jacketed.
7—Double arm sigma blade 5-100 gal.
14—Single arm sigma blade 30-100 gal.
18—Dry Powder—1½ to 77 cu. ft. cap.
3—Day, Ross 40 gal. pony.
1—Olsen & Tilgner 100 gal. change can.
6—Olsen & Tilgner 100-150 gal. lead-

MISCELLANEOUS
Tanks: Stain. steel up to 1200 gal.
Screens: Selectro 3-deck 4 x 10'.
Screen: Robal 40 x 120'' st. steel.
Sterilizers: Climax 20 x 36''.
Feeders: Syntron Vibraflow F-22-new.
Rotary Cutter: Ball 6 Jewell #1½, 20 hp.
Condensers: Tubular st. sis., 16 sq. ft.
Heat Exchanger: Karbate 16.5 sq. ft.
Tubular Heater: CP. st. sts., 65 sq. ft.
Scales: Hopper batch type 50-2000 lb.
Dust Collector: Panghorn 2500 CFM.
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- Shelf 59" x 70".

- Habright. Nell 4" 9" Devide Drum Dryer.

- Abright. Nell 4" 9" Devide Drum Dryer.

- Hall of the Hack. Hack. 1000 Gallon. G.L.

- Eppenbach & Premier Colloid Mills, S.S. 1-50

gph.

- Mixers, D.A. 5 to 200 Gal. Wkg. Cap.

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50 te 1. Moriz. S.S. Tank 3"x2" agit.

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Devine #12 Vac. Shelf Dryer 40" x 42" Shelvas
Gen. Amer 2" x 1" Continuous Retary Vac. Filter
2—Albright.-Heil 4" x 9" Atnes. Drum Dryers.
1—Buffalo Vac. Drum Dryer 24" x 20".
CENTRIFUGALS & CENTRIFUGES
4—Telhurst 40" Suspended Type Centrifugais.
2—Centrifugals 12", 30", 40" & 49" Steel, Copper,
Stainless & Rubber Lined.
Sharples Centrifuges #5A Stainless. Also #5.
3—De Laval Multiple Clariflers #200, 300 & 301.

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1—Dapp 350 gal, C. I. Jack. Vac. Kettle.
Devine (800 gal. doced jack. Steel Kettle.

1—230 gal. vort. agit. Jack. Steel Kettle.

0—Jacketed Kettles 50 George.

60—Statules Alum., Copper, Glass & Lead Lined
Kettles 4 Tanks. Also now Stainless.

1—230 gal. vort. Copper Jack. Kettle.

PULVERIZERS & MILLS
2-Mikro Pulverizers #2TH # 4TH.
Patterson 30" x 42", 6" x 5", 6" x 6" Peable Mills.
Abbe 30" x 30", 30" x 30" Peable Mills.
Abbe 37" x 30 Chrome-Mang, Ball Mill.
#1 Raymond Autematic Pulverizer 20 H.P. meter.
1-Raymond #30 Pulverizer 30 H.P. Compiets.
2-#0000 Raymond Mills.
Sturtevant #0, 18" Hinged Hammer Mill.
Jeffrey 18" x 18" Sinels Rell Drusber.
Buchanna *x 18" Jew Crusber.

Hammer Mills & Pulverizers 3 to 50 H.P.

|—Schutz-O'Neil 20' Pulverizers Also #1.

Williams #3 & 2xx Hammer Mills.

|—Robinson 19" x 22" Attrition Mills.

|—Lohman 4 Roll W.C. 12 x 39" Steel Mill.

|—Steel 3 Roll Mills 9"x32", 12"x30" & 16"x40",

|—9" x 24 3 pr. high steel Roller Mills.

|—Heuchin 18"x30", 4 Roll Granite Stone Mills.

| Ball & Pewell Retary Cutters, Midget Lab. & #1.

| 2—U. S. & Promier 1½ H.P. Colloid Mills.

2—U. S. & Premier 1½ H.P. Colloid Mills.

MIXERS & SCREENS

Lancaster 5' dia. Vert. Mixer 25 H.P.
Baker Perkins double arm 100, 30 # 9 gals.
2—Read 50 # 100 gal. double arm mixers.
2—American Tool 300 gal. Churns.
Kent 3 HP. Continueus Bry Mixer.
Heriz. Mixers single & double arm to 200 gal.
Read 40 # 80 ct. vert. Mixer.
6—Leed & Paste Mixers 50 to 150 gals.
1—Cyler 5' x 5' Vibratory 2 Deck Sersen.
Blystone 3000# horiz. spiral mixer.
10—Dry Spiral Mixers 50 to 3000#.
12—Portable Esec. Agitators ½ to 3 H.P.

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-Mikro Pulverizers 22TH 2 4TH.

- Karson 30" x 42", 6" x 5", 0" x 8" Pebble Mills.

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- be 30" x 30", 30" x 30" Pebble Mills.

- be 30" x 30" x 30" Pebble Mills.

- be 30" x 30" x 30" Pebble Mills.

- be 30" x 30" x 30" Pebble Mills.

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Joday, at Dicalite, we would translate that, very broadly indeed, "Good Heavens! Twenty-five years gone by so soon!" For, as we look back to 1930 and our beginnings, we feel a double sense of wonder... first, that a quarter-century has sped so fast, and then, that we (and diatomite) have come so far in so short a time.

As you know, Dicalite is both our Division name and the family name of a whole host of materials processed from diatomite. This unique material, once regarded as almost an oddity, used occasionally as 'chalk-rock' building stone or in fire-lighters, foday serves important uses in more than 200 industries.

This great expansion is due, in no small part, to the warm cooperation of the industries which we serve. Their laboratories have worked with ours, their product engineers and ours have together pioneered new developments, new uses, for this versatile earth.

Hence, we would like to make this, our 25th milestone, an expression of thanks to the many industries throughout the world whose ready acceptance and continued use of Dicalite

have made possible our growth. Their support has enabled us to advance from 1930's one deposit, one plant, to our present four deposits and four processing plants. Our obligation is cheerfully assumed and Dicalite will contribute even more greatly to industry's progress during our next quarter-century.

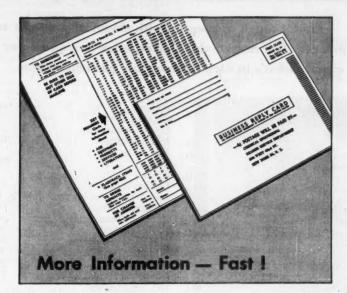


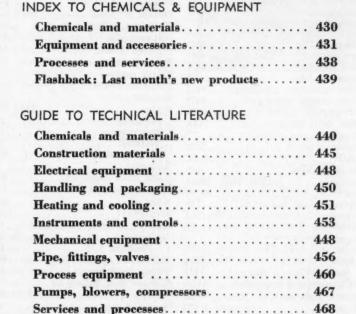




The cryptic headline is from the Roman poet Horace (Odes II, xiv. 1). Its literal translation is "Alas, the fleeting years glide by," but we cannot echo the poet's expression of regret.

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Each item has a code that's the key to its location in this issue. The numerals show the page where you'll find the item mentioned. The letters L (left), R (right), T (top), B (bottom) locate ad positions on the page; the letters a, b, c and A, B, C identify items on a page or in an ad.

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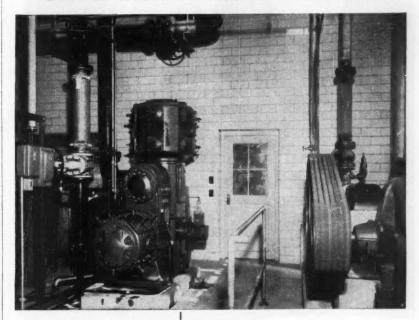
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CHEMICAL ENGINEERING-April 1955

METAL HOSE Briefs

Compressor Piping "Shakes" Cured with Flexon Metal Hose



FLEXON

The Complete Line for Good Connections

REX-WELD corrugated hose in steel, bronze and other alloys; sizes 3/16" through 24", I.D.; for burst pressures up to 12,000 psi.

REX-TUBE interlocked hose in steel, bronze, stainless steel and other alloys; sizes 3/16" through 12", I.D.; for low and moderate pressures.

STANDARD ASSEMBLIES of Rex-Weld and Rex-Tube for specific services are also available.

CATALOG 130R gives specifications on Flexon Metal Hose. Write for your copy.

Vibration was the problem in this compressor house. Prior to the installation of Rex-Weld flexible metal hose sections, much trouble was experienced with loosened connections that resulted in excessive pounding in the lines. The problem was further complicated by pulsating pressure and an operating temperature range of 70° to 300° F. which caused some axial motion.

36" lengths of 6" and 4" braid covered Rex-Weld corrugated steel hose solved the problem completely. If you have connection problems involving vibration, misalignment, or expansion, call your Flexonics Distributor. He will supply the right Flexon Hose for your application.

Flexonics

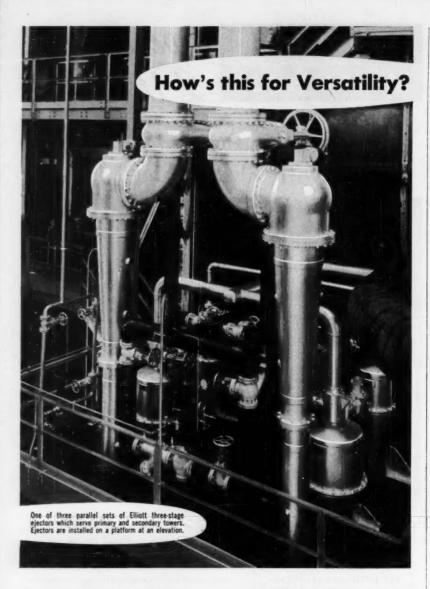
CHICAGO METAL HOSE DIVISION

1317 S. THIRD AVENUE • MAYWOOD, ILLINOIS
FORMERLY CHICAGO METAL HOSE CORPORATION—

Flexon identifies products of Flexonics Corporation that have served industry for over 53 years.



Manufacturers of flexible metal hose and conduit, expansion in joints, metallic bellows and assemblies of these components. In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario



ELLIOTT Steam Jet EJECTORS

This installation in a large oil refinery called for three parallel sets of Elliott three-stage steam jet ejectors. Parallel ejectors permit one set to be shut down during reduced rates, making for greater economy in steam consumption. They operate on 100 psig steam, maintaining vacuum on both the main unit and the secondary tower. Tower pressure is controlled by recycling gases from the third-stage ejector discharge back ahead of the first stage ejector.

Whenever vacuum is required, it pays to utilize the knowhow of Elliott ejector specialists. Contact your Elliott representative or write Elliott Company, Jeannette, Pa. for descriptive bulletins.

ELLIOTT Company



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ROCKWELL-BUILT Edward VALVES

FOR LOW COST-High Performance



- EDWARD FORGED STEEL STOP VALVES

RATINGS* to 2000 lb WOG or 850 lb at 750 F

SIZES: 1/4, 3/4, 1/2, 3/4 and 1"

Fig. 444—Globe—OS&Y—union bonnet—screwed or welding ends

Fig. 445—Angle—OS&Y—union bonnet—screwed or welding ends

Fig. 2698—Globe—inside screw—union bonnet—screwed or welding ends

Fig. 2699—Angle—inside screw—union bonnet—screwed or welding ends

SIZES: 11/4, 11/2 and 2"

Fig. 448—Globe—OS&Y—bolted bonnet—screwed or welding ends

Fig. 449—Angle—OS&Y—bolted bonnet—screwed or welding ends

*Other Edward Stop Valves available with ratings to 7500 lb WOG, 3250 lb at 1100 F

For more details on these as well as other Rockwell-Built Edward forged and cast steel valves write for the Edward Condensed Catalog.

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY 1224 West 145th Street, East Chicago, Indiana





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opens the way
to pump valve efficiency



Apply pressure to the outside edge of the valve member with a pencil point. Notice how it tilts and opens with a light pressure, without noticeable friction.

ORDINARY VALVE

Now try this with an ordinary valve. If the valve opens at all, it will only open part of the way, and with excessive friction.

All reciprocating pump valves are subjected to flow forces which necessitate tilting of the valve member while opening. In applying pressure through the seat with a pencil point to the outer edge of the valve member you approximate operating action.

mate operating action.

In a DURABLA Valve only "point contact" is made by the valve member on the stud or sleeve, so it cannot bind or hang-up on the guard stem, but opens with a tilt-action following the flow line. Other types of valves using wings for seat guiding or high hubs for stem guiding, cannot avoid creating excessive wear and friction, with resultant warpage and possible breakage of valve or stud.

The unique DURABLA Stain-

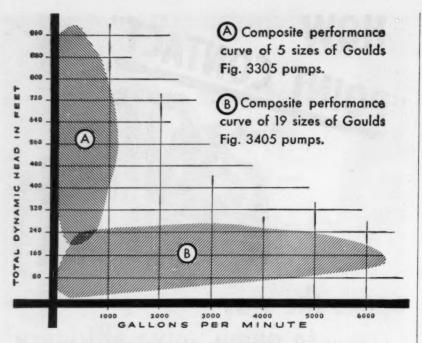
The unique DURABLA Stainless Steel Valve will operate freely under extremes of high or low temperature, with highly corrosive fluids, and in any position. It will handle vacuums of one micron or discharge pressures of thousands of pounds per square inch. Standard equipment on many pumps, it will fit ANY pump, old or new. Ask for bulletin MF-3.



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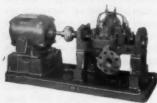


Do you need pumping capacity?

... or head? ... or both?



Goulds Fig. 3405 single-stage pump



Goulds Fig. 3305 two-stage pump.

With these two groups of Goulds centrifugal pumps you can meet an extremely wide range of pumping requirements.

For volume pumping, 19 sizes of the Fig. 3405 single-stage, double-suction pump provide capacities up to 6,400 GPM, and heads to 280 ft.

For greater pressure requirements 5 sizes of the Fig. 3305 two-stage pump provide heads up to 1,000 ft., and capacities to 1,200 GPM.

Both of these groups of pumps have important new design and construction features that insure efficient operation and long life. Yet, because so many of their parts are interchangeable, you can cut your parts inventory in two—or better.

For example, you need only 3 different shafts for all 24 sizes of

pumps in both groups.

We'd like to send you additional details about these pumps, including specifications and performance curves. Just write for Bulletin 721.6 about the Fig. 3405 single-stage pumps, and Bulletin 722.6 about the Fig. 3305 two-stage pumps. We'll be glad to send you copies of both.



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Automation is an empty word if your production is interrupted by material hang-up in bins and hoppers. That all-important initial step of material introduction must move smoothly, flawlessly or the whole concept of automation is destroyed. PneuBin will solve your flow stoppage problems and reduce your operating expense. The PneuBin unit consists of steel-backed, neoprene, pulsating panels mounted on the inside walls of your present bins, and air controls to regulate the panels' action. By the pneumatic inflation of the PneuBin panels, the bin contents are positively displaced to insure free flow. Automatic inflation and deflation continues in cycles at whatever frequency is set on adjustable control. PneuBin operates off the regular plant air supply.

PneuBin decreases plant operating costs by reducing maintenance and adding to the life of your bins; insures constant material flow; and greatly increases personnel efficiency through its quiet operation.

Send for "Flow Stoppage Report" and FREE literature. PneuBin engineers will gladly make recommendations with no obligation on your part.

SOME FRANCHISED SALES TERRITORIES STILL AVAILABLE



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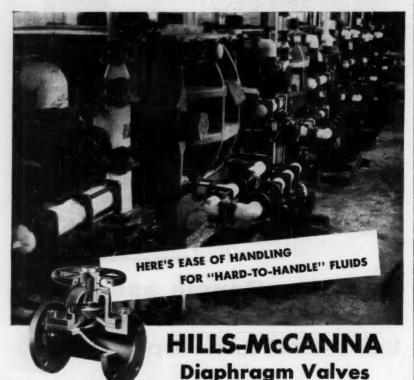
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1525 Maryland Ave., Baltimore 3, Maryland



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Antibiotics to Zinc chloride



The range of "hard-to-handle" liquids, gases and slurries that can be handled successfully with Hills-McCanna diaphragm valves is virtually without limit. From antibiotics which are being handled in the plant pictured above to the toughest acids, alkalis and salts, there is a combination of Hills-McCanna body and diaphragm materials that will best suit your needs.

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If you valve any "hard-to-handle" fluid, it will pay you to take advantage of Hills-McCanna's extensive experience. For specific recommendations, send an outline of your requirements. Or, if you prefer, write for your copy of the Hills-McCanna valve catalog.

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Magnesium Alloy Sand Castings

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Looking for something?

You can bank on spotting it—and fast—in our new, master Index to Chemicals & Equipment in this issue. You'll find it a complete, finger-tip reference to this month's advertised items and new product developments.

Flashback.

To make sure that you don't miss any news that could help you with your job, Chemical Engineering is doing a double take for you. The index below repeats the editorial listings only on chemicals, equipment and services featured last month in New Equipment and in Chemicals and Raw Materials. Use the postcard (p. 443) for more information on any items.

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What It Contains . . .

This is a comprehensive listing of the latest literature you can now get from manufacturers on chemicals, equipment and services in all fields of interest to chemical engineers. It lists new publications just released, in addition to technical literature mentioned in the advertisements in this issue. The latter are identified by an asterisk (*) alongside the company name.

For More Information . . .

You can get—and get fast—more information on any publication listed in this guide by using the Reader Service post-card inside the back cover. Simply circle the item's code number on the postcard, fill in your name and address, then mail to us. Ask for as many as you need. Answers come to you direct from the companies putting out the literature.

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Guide to Technical Literature

Want to build up your files and keep them up-to-date?
This comprehensive guide to available literature will help you do just that. They're yours—free—for the asking.

Chemicals

- Acid Anhydrous, Hydrofluoric 40 p.
 book contains valuable information
 concerning hydrofluoric acid anhydrous. Provides useful data for those
 who now use HF, or for those who
 are contemplating its use.
 288a *Harshaw Chem. Co.
- Acids, Fatty.....Mineral ore output by froth flotation is on the increase, & General Mills assisted in the development with Allphats specifically designed for ore flotation. Full data on inexpensive fatty acids.

 287e *General Mills.
- Addition Agents.....Santolene J, a new addition agent, reduces sedimentation of base oils. Describes this valuable product and contains results of stability, sedimentation and rusting tests, in Technical Bulletin.

 32-3e *Monsanto Chem. Co.
- Additives.....Lubricants compounded with Santopoid 44 provide complete passenger car hypoid protection under the most severe road test and laboratory conditions. Find complete details in Technical Bulletin.

 32-34 *Monsanto Chem. Co.
- Alcohols, Fatty.....Alcohols of almost any desired chain length or degree of unsaturation can be produced commercially from natural fats & oils by sodium reduction process. Data in "Fatty Alcohols for Industry."

 440A Ethyl Corp.
- Alkyds, Glycerine.....New 20 p. booklet offers practical value to users of alkyds as well as resin manufacturers. Assists in selecting alkyd resin that best meets specific needs of each coating requirement.

 440B Glycerine Producers' Assoc.
- Alkylsodium Compounds.....Alkylsodium compounds are sodium derivatives of high reactivity and interesting properties. Describes properties, preparation, typical reactions, etc. in new, detailed Fact Sheet.

 440C Ethyl Corp.
- Alumina Trihydrates.....Company's line of organic free alumina trihydrates can help improve your products... and reduce costs. For complete details refer to valuable brochure, "Reynolds Aluminum Chemicals."

 440D Reynolds Metais Co.
- Ammonium Thiocyanate.....Specification Manual gives complete information on the properties and uses of ammonium thiocyanate, properties of aqueous solutions of ammonium thiocyanate, etc. Fully detailed.

 315

 *J. T. Baker Chem. Co.
- Aromatics, Coal Tar.....Used extensively in the paint and varnish industry where good solvency and controlled evaporation rate are required. Company furnishes complete specifications and samples on request.

 440E Pennsylvania Indus. Chem.
- Benzene Phosphorus Thiodichloride......
 Coloriess liquid which fumes slightly
 in air. A reactive acid chloride which
 hydrolyzes very slowly in water but
 reacts with alcohols, phenols &
 amines, Product sample.
 440F Victor Chem. Wks.

- Borotherm.....A Brochure, which includes all available information on this new product, is issued as a guide for the numerous industries in which Borotherm may have applications as a fire-resistant material.

 4406 American Potash & Chem.
- n-Butyl Acetate.....Traditional medium evaporating solvent for lacquers as well as solvent for gums, fats, chlorinated rubber compounds, vinyls, polystyrene, etc. Properties & specifications. Bulletin N-36-1. 440H Celanese Corp. of America.
- n-Butyl Benzoate.....Offers description of: properties; shipping container contents; resin solubilities; applications as solvent, as extractant, & as intermediate for benzoate esters & alkyd resins. Bulletin F-8109. 4401 Carbide & Carbon Chem.
- Calcium Carbonates, Precipitated....

 Possibilities of cost reduction with minimum effect on physical properties by using Witcarbs V & P in filling vinyl chloride resins, suggested in new Technical Service Bulletin W-2.

 440J Witco Chem. Co.
- Calcium Chloride.....Tables, graphs, applications in 64 p. Covers properties, use, and control of straight calcium chloride as brine medium in refrigeration and ice manufacturing systems. Bulletin No. 4.

 147a *Solvay Process Div.
- Carbon Dosage.....By means of a Darcograph, you can plot relation between color adsorption & Carbon dosage—& read off dosage for residual color you need. Request Darcograph along with instructions on how to use it.

 *Darco Dept.
- Catalysts.....Announces the availability of revised Product Data Sheets containing valuable information on powdered and pelleted vanadia oxidation catalysts and indicating silica gel for protective packaging.

 440K Davison Chem. Co.
- Chemicals......Company announces the availability of a new publication, "Chemical Progress," which furnishes detailed information relating to the numerous different products in their line. Request Vol. 1 No. 1.

 440L Carbide & Carbon Chem.
- Chemicals..... Issues second edition of the Reilly Chemical Index. Contains essential information on over 100 organic compounds & includes 13 new chemicals. Listings are alphabetical and according to class. 8 p. 440M Reilly Tar & Chem. Corp.
- Chemicals, Industrial.....Company makes available their latest reference covering industrial chemicals line. The handy alphabetical listing will help you to find quickly the chemicals you require. Illustrated, 24 p. 440N Harshaw Chem. Co.
- Chemicals for Metal Finishing......
 Chemicals of interest to metal finishers include: citric, tartaric, gluconic & oxalic acids, & their salts. Request Technical Bulletin 61, "Chemicals for Metal Finishing."

 *Chas. Pfizer & Co.
- Chlorine.....Offers valuable technical bulletins: #7—"Liquid Chiorine"; #8—"Alkalies & Chlorine in Treatment of Municipal & Industrial Water"; #11—"Water Analysis"; #14—"Chlorine Bleach Solutions."

 147b *Solvay Process Div.

- Chlorine, Liquid..... Presents new 72 p. technical and engineering service bulletin, "The Analysis of Liquid Chlorine and Bleach." Literature contains valuable data, tables, charts and indexes. Bulletin No. 12.

 147e *Solvay Process Div.
- b-(o-Chloroanilino) Propionitrile......
 Soluble in ethanol, ether, acetone, benzene and chloroform; insoluble in water, hexane. Data Sheet covers appearance and color, nature of impurities, chemical properties, etc.

 441A Monsanto Chem. Co.
- Copper Sulphate Crystals.....New improved industrial crystals copper sulphate is readily adaptable to all types of solution equipment. Samples, specifications & detailed information made available upon request.

 41B Tennessee Corp.
- Defoamers.....For more efficient foam control. Versatile defoamers save space now wasted on foam, cut the processing time, eliminate waste & fire hazard of overflowing foam, etc. Offers complete data & samples.

 8370 *Dow Corning Corp.
- Defoamers.....New defoaming agent, Defoamer PC-1244, is particularly effective in systems where the continuous phase is organic in nature or in single-phase organic systems. Technical Bulletin No. 0-76.

 32-3b *Monsanto Chem. Co.
- Dihydroxy Diphenyl Suifone.....Shows promise as an ingredient in production of heat-resistant epoxy and phenolic resins. Covers properties, specifications, chemical reactions, uses, etc. Bulletin No. 0-118. 32-3d *Monsanto Chem. Co.
- Dioctyl Phthalate.....A truly high quality dioctyl phthalate whose combination of low color, low odor, low acidity, high heat stability and high ester content is unsurpassed. Specifications and sample quantities.

 4410 Eastman Chem. Products.
- Dispersions.....Issues new illustrated booklet discussing use of "dag" colloidal graphite as a parting compound. Specific "dag" dispersions for industrial uses & techniques of application. Bulletin 427.

 441D Acheson Colloids Co.
- yellow papers for writing tablets and other uses is represented by Cyanamid's improved Pheno and Pheno Fast Yellows of the Stilbene Group. Literature and product sample.

 20-1a *American Cyanamid Co.
- Emulsifiers.....Valuable data on use of Atlas emulsifiers in "A Guide to Formulation of Industrial Emulsions with Atlas Surfactants." Booklet contains over 60 typical formulas utilizing Atlas products.

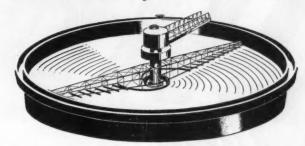
 441E Atlas Powder Co.
- Ethylene Oxide......Carbide offers you consistent, high-quality material in the quantity you need—when you need it. Request valuable reference, "Operating Procedures for Handling Ethylene Oxide," Form 7613.

 143 *Carbide & Carbon Chem.
- Fluxes, Rosin, Insulating.....Testproven to be the best rosin flux for vhf., uhf. and microwave applications, as well as general types of electrical work. Covers line of fluxes, rosin core solder, fluxcote, etc. 441F London Chem. Co.
- Formaldehyde.....U.F. Concentrate— 85 is highest concentration of liquid formaldehyde commercially available ...55% formaldehyde and 26% urea in a water solution. Request full details and valuable Folder. 233 *Nitrogen Div. AC&D
- Furfural.....Rely on furfural for performance ...uniform purity ... low cost ...unfalling availability. Offers test sample & descriptive Bulletin (204) covering its unusual properties and numerous uses. 4416 Quaker Oats Co.
- * See explanation on p. 440

Hardinge Equipment for

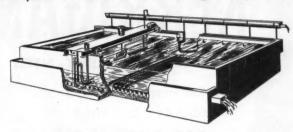
- WATER TREATMENT
- LIQUID WASTE DISPOSAL
- BY-PRODUCT RECOVERY

Circular Clarifier or Thickener



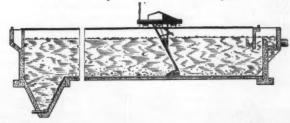
A unit which promotes rapid settling and quick sludge removal by means of spiral scrapers and central discharge opening.

Automatic Backwash Sand Filter



A filter for industrial supply water or liquid waste which removes fine suspended solids and cleans its own filter bed with a traveling backwash carriage.

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LITERATURE . . .

cerine.....Offers valuable booklets including "Glycerine—Preferred for Product Conditioning," which out-lines properties that make glycerine preferable in conditioning tollet goods and pharmaceuticals. 289 *Glycerine Producers' Assoc. Glycerine.

Iron Oxides, Red.....Compared with other standard Copperas Reds, "100" series is: brighter in color; finer in particle size; lower in oil absorption; higher in purity; etc. Offers product samples and details.

358 *C. K. Williams & Co.

Lithium Metal.....Lithium has been used for many years in metallurgy as a degasifier, deoxidizer, desulfurizer and general purifying agent. Data Sheet covers chemical behavior, applications, purity, etc.

442A Lithium Corp. of America.

Mercaptobenzoxazole Technical Data Sheet supplies pertinent information concerning: structure; appearance; chemical properties; odor; melting point; nature of impurities; solubility; stability; & uses.

442B Monsanto Chem. Co.

Methyl Glucoside.....New low-cost polyol for use in making resinous coatings, varnishes, drying oils, and surface active agents. Company furnishes product samples and descriptive technical literature.

442C Corn Products Refining Co.

Mineral Spirits, Oderless.....Amsco odorless mineral spirits manufactured under rigid control to meet exacting specifications. Complete technical in-formation, prices, and samples avail-able upon request.

442D American Mineral Spirits.

Monomers, Acrylate & Methacrylate.....
Ability of copolymers containing acrylates or methacrylates to resist aging is superior to that of corresponding acrylic-free polymers. Information in 38 p. Booklet.

442E Rohm & Haas Co.

Naphthas, Heavy, Coal Tar.....These are semi-refined, selected coal tar fractions having excellent solvency for applications ranging from wire enamels to roof coating compounds. Offers specifications and samples. 442F Pennsylvania Indus. Chem.

e-Nitrobenzenesulfenyl Chloride.....Sol-uble in benzene, acetic acid, and chloroform; alightly soluble in ether and carbon tetrachloride. In general, it undergoes reactions similar to acid chlorides. Request Data Sheet. 442G Monsanto Chem. Co.

o-Nitrochlorobenzene.....Presents a 35-by-44 inch wall chart showing more than 120 organic syntheses based on o-Nitrochlorobenzene. Also contains a literature summary of potential uses for 19 ONCB derivatives. 32-3e **Monsanto Chem. Co.

Oils, Heat Transfer.....If your heat transfer requirements go up to 600° F., you will find that S/V Heat Transfer Oil 600 is the best medium you can use. Bulletin offers complete information on benefits.

101 *Socony-Vacuum Oil Co.

Phosphorus Thiochloride.....Phosphorus thiochloride is a faint yellow to color-less liquid with a distillation range of 120-125°C. Typical analysis: 18.5% phosphorus and 18.6% sulfur. Request product sample.

442H Victor Chem. Wks.

Phthalic Anhydride.....Recommenda-tions for in-plant handling of versa-tile compound in either liquid (mol-ten) or fiake form fully discussed, along with special phthalic anhydride shipping methods, in new booklet. 32-3h *Monsanto Chem. Co.

Phthalic Anhydride.....Aero phthalic anhydride—another Cyanamid quality intermediate—is immediately available in both pure white flake and moiten form. New Technical Bulletin covers properties & handling.

20-1b *American Cyanamid Co.

• See explanation on p. 440

- Plasticizers.....Santicizer 160 offers valuable advantages: it has a wide range of compatibility, resists abrasion and extraction by various oils, gasoline and water. Data in Technical Bulletin No. 0-92.

 32-3a *Monsanto Chem. Co.
- Polyacrylamide.....Adhesives made with polyacrylamide have greater tack when wet, higher strength and water resistance when dry. Company makes available upon request complete literature and a product sample.

 20-1c *American Cyanamid Co.
- Pyridexine Hydrochloride Pewder.....
 A fine, white crystalline powder; odorless. Many uses: an additive to enrich certain food products; in treatment of vitamin deficiency; etc. Technical information Sheet.

 483 Mallinckrodt Chem. Wks.
- Beagents.....Aerofloc reagents greatly increase settling & filtration rates by efficient flocculation of aqueous suspensions of ores, mineral & metal particles, industrial wastes, etc. Literature & product sample.

 20-1e *American Cyanamid Co.
- Resins....."Polymer Progress" (No. 1) includes sections on: Epon 828 in tooling applications; the chemistry of ouring Epoxy resins; Epon adhesives in military applications; experimental Epon curing agent U,

 443B Shell Chem. Corp.
- Resins.....White leathers stay plump & round through the pasting & drying process with Cyanamid's Tanak MRX water-soluble melamine resin in tanning solutions. Request detailed literature & product sample.

 20-1d American Cyanamid Co.
- Resins, Polyamide.....Company's line of polyamide resins may be applied as heat-seal adhesive, by either hot melt or solvent solution technique. They bond at moderate temperatures. Complete technical information.

 287a "General Mills.
- Resins, Tetrafluoroethylene.....64 p. fully illustrated Manual describes Tefion tetrafluoroethylene resin—the history, general characteristics, manufacture, uses, properties, processing techniques, etc.

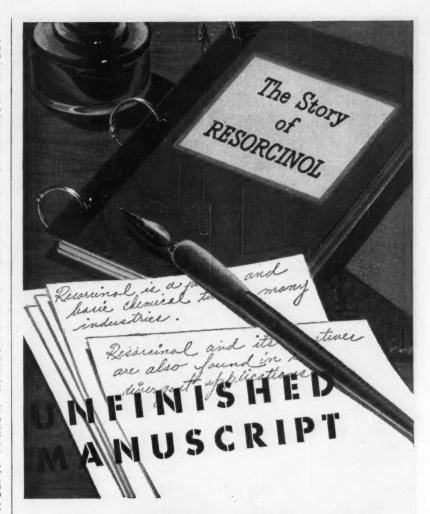
 4430 E. I. du Pont de Nemours.
- Resin Amine Derivatives.....Numerous new opportunities for product improvements offered by Hercules' group of water-soluble rosin amine derivatives. Covers water-soluble, oilsoluble & acid-soluble types. 443D Hercules Powder Co.
- Sesquicarbonate of Soda.....Comprehensive new booklet, "Snowflake Crystals and Snowfine," offers complete information on physical and chemical properties, Fully illustrated with photographs, tables and graphs, 443E Solvay Process Div.
- Silica Gei.....Company announces the availability upon request of data sheets on "Reactivation of Bulk Silica Gei" & "Regeneration of Protek-Sorb 121"—the latter being the Davison packaging dessicent.

 443F Davison Chem. Co.
- Seda Caustic....."Caustic Soda Buyer's Guide" contains helpful facts on economics of 50% & 73% solutions; other forms of caustic soda; capacities of tank cars & other containers; useful shipping data; etc. 78 Hooker Electrochem. Co.
- Sofia, Caustic.....Technical & engineering service bulletins cover a wide scope of subjects. Includes: physical & chemical properties, use, handling & storage of caustic soda, soda ash. Bulletin Nos. 5 & 6.

 147d *Solvay Process Div.
- Sodium.....Valuable booklet, "The Chemistry & Uses of Sodium" presents a high-spot survey of some of the reactions of sodium, so that you may better visualize its possible uses in your industrial operations.

 443G Ethyl Corp.

• See explanation on p. 440



... perhaps YOU can add a chapter!

RESORCINOL is a familiar and basic chemical today in many industries. Besides its better-known uses in waterproof wood bonding and the bonding of reinforcing fibers to synthetic and natural rubbers, Resorcinol and its derivatives also are found in such applications as dyeintermediates, tanning agents, light stabilizers and medicinals.

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Write today for samples for your own experimentation — and for more detailed information about this chemical that may be the key to new or improved products in your field.

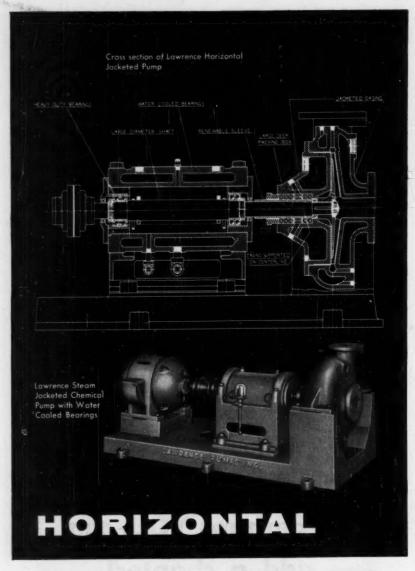
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the center line of the shaft.

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Write for Bulletin 203-7.





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LITERATURE . .

- Sodium Alcoholates.....Valuable, varied and versatile . . . can be prepared from sodium and most desired alcohols at low cost, thus providing economically attractive raw materials for many uses. Request Booklet, 444A Ethyl Corp.
- Sodium Citrate..... Electroless nickel plating of intricate insides with ...
 Pfizer sodium citrate as your sequestering and buffing agent. For details, request Technical Bulletin 68, "Electroless Nickel."
 74a *Chas. Pfizer & Co.
- Solvents.....Issues a new, illustrated, 44 p. booklet entitled, "Cellosolve and Carbitol Solvents." Describes in detail the nine commercial glycol-ethers sold by the company. Request Booklet No. F-4765.

 444B Carbide & Carbon Chem.
- Solvents.....2-50-W Hi-Flash solvent offers you: high flash point; high solvency power; good odor; coal tar origin; slow, even evaporation rate; attractive low price; etc. Samples and prices available on request, 91

 *Neville Chem. Co.
- Solvents.....Assure controlled evaporation. In paint & surface coating industry... solvents offer precise characteristics to meet your most exacting requirements. Full data on characteristics & specifications. 89 *Esso Standard Oil Co.
- Surface Active Agents.....Anti-static agent Cationic SP is a boon to processors of materials such as textiles, plastics & paper since it is applied easily & eliminates troublesome static. Literature & samples.

 4440 American Cyanamid Co.
- Surface Active Agents.....Cationic surface active agents found useful in a wide variety of applications. Offers new booklet describing the properties and characteristics of "Armeens"—primary and secondary amines.

 444D Armour & Co.
- Tetrapotassium Pyrophosphate Detailed examination of present and potential uses of TKPP in a variety of industries. Data on properties, sequestration, etc., in 4 p. Technical Bulletin No. 505 R.

 444E Westvaco Chem. Div.
- Titanium Hydride.....Features numerous uses: ceremic-metal seals; electronic getter; furnace atmosphere; hydrogenation agent; refractories; etc. Details on properties and uses contained in Bulletin No. 601.

 444F
- Tri-o-Cresyl Borate.....Covers formula, molecular weight, density, boiling point, flash point, color, odor, solubility in organic solvents, stability in water, etc., in Product Technical Data Sheet No. 8/OB.

 4446 Pacific Coast Borax Co.
- Vermiculite.....Over 40 industrial applications of vermiculite are listed in 1955 revision of Data Book on the mineral's chemical and physical properties. Request this fully-illustrated, 16 p. reference. 2444H Zonolite Co.
- Waxes.....Manufacturers of rubbing compounds, waxes, lamb wool products, automotive finishing & refinishing specialties offer fully illustrated folder covering numerous advantages of Mirroriz auto paste wax.

 Kammel Products Corp.
- Waxes, Microcrystalline Company makes available fully detailed information on microcrystalline and synthetic waxes, in various technical booklets, bulletins and price lists. All obtainable on request.

 4444 Petrolite Corp.
- Weed Killers, Borate.....New Service
 Bulletin describes Tronabor as a nonpoisonous, non-corrosive borate weed
 killer that permanently sterilizes soil
 beneath a paved surface. Provides
 complete information.

 444K American Potash & Chem.
- * See explanation on p. 440

An ingredient contributing smoothness, unctuousness and covering power to pharmaceutical and cosmetic preparations. Find complete details in Technical Information Sheet. 445A Mallinckrodt Chem. Wks.

Construction Materials

- Adhesives, Epoxy Besin.....Company has undertaken active manufacture & development of epoxy adhesive formulations. Furnishes literature covering type & description, typical functions, etc. Bulletin EP-54-33.

 445B Furane Plastics.
- Alleys.....Tabbed, easy-to-use, 24 p. with latest copper & copper-alloy specifications—ASTM, ASME, AWS, SAE, AMS, Federal, Military, Army, Navy & Joint Army-Navy specifications. Pub. No. B-34R.
 445C American Brass Co.
- Alloys, Aluminum Casting.....New 60 p.

 "Aluminum Casting Alloys Handbook"
 consolidates all important specifications pertaining to these alloys—Federal, Navy, Military, SAE, AMS, ASTM & Federated. Hlustrated.

 445D Federated Metals Div.
- Alloys, Hardfacing.....Bulletin covers the Spraywelder & Colmonoy alloys available for use with the new Model C—which features greater spraying capacity & deposit efficiency than previous models. Illustrated.

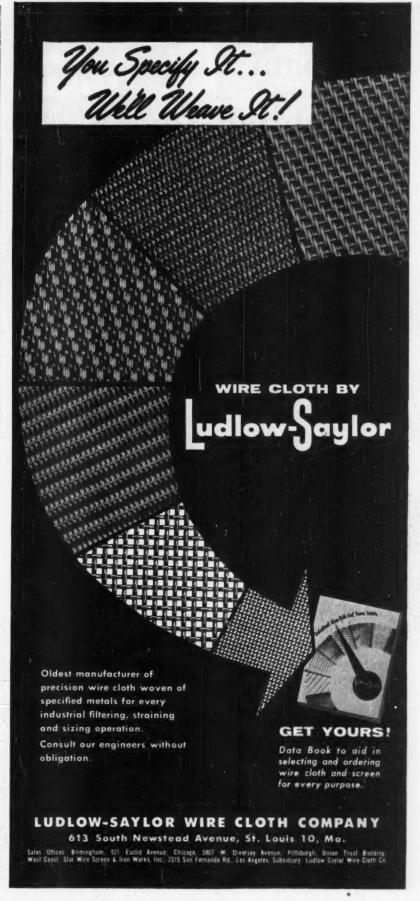
 445E Wall Colmonoy Corp.
- Alloys, High Tungsten.....New reference covers latest data on machinability & other physical properties of Hevimet, a high tungsten alloy—twice as heavy as lead—produced by powder metallurgy. Data Sheet HV-4. 445F
- Aluminum "Aluminum in the Process Industries" outlines the economic and technical advantages of aluminum used in processing equipment for chemical and material storage, and for transporting liquids. 8 p.

 445G Aluminum Co. of America.
- Castings.....Presents an illustrated 4 p. folder covering range (large to small) of electric furnace carbon and alloy steel castings. Includes a pictorial review of available product literature. Form No. 20-LP.

 4451 Farrell-Cheek Steel Co.
- Castings, High Alloy.....Duraloy high alloy castings to your order ... large-small—special shapes—corrosion-resistant heat-resistant abrasion-resistant—etc. Offers details in Bulletin No. 3354-G. 356 *Duraloy Co.
- Castings, Stainless Steel.....32 p. of valuable and complete information on stainless castings: analyses, properties, technical data on handling and heat treatment, typical applications, how to order, etc.

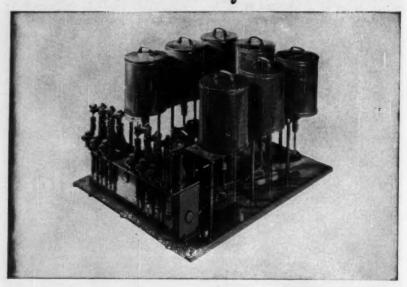
 404 *Allegheny Ludium Steel.
- Coatings, Protective.....Describes pressure-packed protective coatings—rust preventive coatings, instant dry enamels, instant paint remover, window glass paint—in time-saving, trouble-free spray cans, 4 p. 445J Wilbur & Williams Co.
- Coatings, Protective.....Fluorinax is a new resin-based coating fundamentally derived from the polymerization of fluorine monomers. Complete description & properties in Technical Service Data Bulletin FLX. 445K Rubber & Plastics Compound.

• See explanation on p. 440



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LITERATURE . . .

- Fabrication, Process Equipment.....Designed and built around the use of Haveg—basic construction material that resists corrosion. Includes size and chemical resistance charts in 64 p. illustrated Bulletin F-6. 92a *Havey Corp.
- Finishes, Maintenance.....Company issues a new painting specifications and product guide which features a two-page Selector Chart for correct matching of all types of maintenance finishes to surfaces.

 446A Glidden Co.
- Grout & Mortar, Pre-Mixed.....Offers 2 illustrated folders covering premixed grout (8 p.) & pre-mixed mortar (4 p.). Fully describes advantages & give directions for use in performing numerous applications.

 446B Master Builders Co.
- Irons, Engineering.....28 p. basic reference compiled primarily for design engineers offers the many valuable characteristics of modern nickel cast irons & illustrates acceptance in industry. Bulletin No. A-69. 446C International Nickel Co.
- Lead Products.....Illustrated, 44 p. compilation of data on lead & lead products. Covers advantages of lead as construction material & describes grades, sheet lead, lead pipe & fittings, etc. Bulletin No. 162.

 446D Federated Metals Div.
- Linings, Rubber.....Company presents a fully illustrated, 2-color Bulletin which describes the advantages and application of rubber lining to steel tanks, drums, pipes, valves, fittings and pumps. 8 p.

 446E Metalwald, Inc.
- Panels, Structural.....Describes Daycor
 —the new, translucent fiberglass
 building panel. Illustrates the numerous uses . . as office partitions,
 shower enclosures, carports, patio
 covers, awnings, etc.
 446F Strick Plastics Co.
- Platinum, Gold & Silver.....Company announces the availability upon request of a descriptive reference entitled, "Platinum, Gold and Silver for Science, Industry and the Arts." Identified as Folder No. C-20. 336 *American Platinum Wks.
- Preventives, Rust.....Illustrated, 24 p. offers outstanding treatise on rust prevention. New catalog features 98 color chips of products & includes instructions for surface preparation & application. Form No. 254.

 4466 Rust-Oleum Corp.
- Refractories.....Illustrated, 24 p. offers latest physical & chemical properties on Super refractories. Included are lists of applications & pertinent charts & tables. "Properties of Super Refractories."

 Carborundum Co.
- Steels, Stainless....."Welding and Soldering of Armco Stainless Steels" covers all types of welding, lists electrode and filler rod recommendations for the standard types of Armco stainless steels, 52 p. Manual.

 4461 Armco Steel Corp.
- Steels, Stainless.....Offers extensive data on drawing & forming of stainless steels in 28 p. completely illustrated fabrication manual. Request "Drawing, Forming, Spinning & Cutting of Armco Stainless Steels."

 446J Armco Steel Corp.
- Tin.....New, 20 p. booklet tells important story of Straits tin and its many uses today. Includes sections on new tin alloys, tin solders, tin chemicals.

 Covers tin resources and supply. Completely illustrated.

 Malayan Tin Bureau.

April 1955—CHEMICAL ENGINEERING

* See explanation on p. 440



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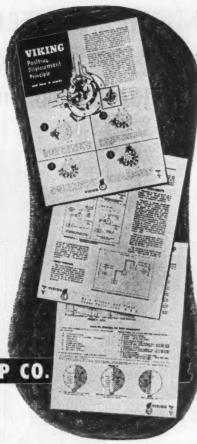
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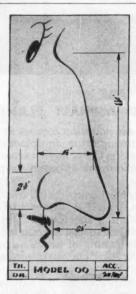
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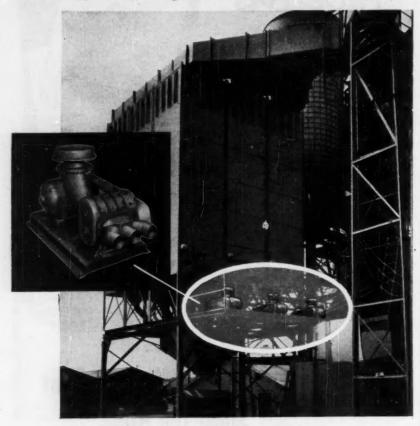


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HOW PRECIPITATOR COSTS ARE REDUCED FOR GRAVEL AND ASPHALT PLANT

The nation's growing battle against air pollution focuses attention on the need for modern precipitator equipment. Manufacturers like Western Precipitation Corp. have learned how Miehle-Dexter Positive Displacement Blowers help assure smoke and dust abatement.

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LITERATURE . . .

Titanium.....Resists chlorides and other corrosive chemicals as no other structural metal can. Offers general booklet on titanium plus a new technical bulletin with valuable data on corrosion-resistant properties.

*E. I. du Pont de Nemours.

Titanium.....Shows resistance to chloride solutions and retains useful strength up to 800-1000F. Other advantages and data on application and fabrication of titanium alloys in descriptive Rem-Cru Review.

385

Electrical & Mechanical

Fixtures, Explosion-Proof.....Standardized Unilet body permits 58 second interchange of 60 watt to 500 watt fixtures...saves time, prevents shutdowns. Bulletin provides full details on AA-51 Series. 77 *Appleton Elec. Co.

Gaskets, Teflon.....The ideal seal for many process applications is a Flexitallic gasket with teflon trapped between edges of stainless steel. For complete data request folder, "Teflon in Flexitallic Gaskets." 324 *Flexitallic Gasket Co.

Gears, Double Helical New reference on double helical gears furnishes pertinent information on specifications, construction design, testing and various applications. 12 p. illustrated Bulletin No. 1958E.

448A Worthington Corp.

Metors.....Cast iron frame motors for extra protection in corrosive atmospheres. Features include completely protected laminations, special varnish treated windings, a running shaft seal. Bulletin MU-132.

96 *Wagner Elec. Corp.

Motors.....Introduces complete new line of industrial direct-current motors—
Super "T." Described as producing fastest & most accurate response ever offered in standard design motor. Illustrated Bulletin C-2002.

448B Reliance Elec. & Engrg. Co.

Packings, Saddle Tower.....The sharply lower pressure drop characteristics of Intalox saddles effectively reduce tower operating costs in numerous ways. Data in Intalox Saddle Packing Bulletin 18-29.

**U. S. Stoneware Co.

Seals, Mechanical.....Can be installed in only 20-30 minutes—require no special holding clamps or machining of stuffing box faces. Completely interchangeable with stuffing box packing. New Bulletin CP551. 448C Chemical & Power Products.

Seals, Mechanical......Combining chemically impervious teflon with a balanced bellows design—Chemiseal external mechanical seals last longer & give unsurpassed performance. Details in Bulletin No. MS-954.

341

Seals, Mechanical.....Describes and illustrates company's line of Flexibox mechanical seals . . . for the process industries. Includes data on advantages, applications, capabilities, etc., in 12 p. Bulletin No. 10.

448D Sealol Corp.

Starters.....Combination starters make neater & safer installations. Feature simple design—quality workmanship—maintenance free contacts—long life. For complete details, request Bulletin No. 712-713.

**Allen-Bradley Co.

Switches, Rotary Limit.....Announces availability of a new Technical Brochure detailing applications & construction features of rotary limit switches. Includes specifications, prices & installation dimensions.

448E' Gemco Elec. Co.

* See explanation on p. 440

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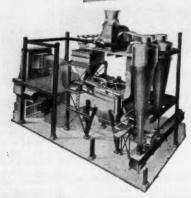
301 PORTLAND AVENUE MINNEAPOLIS 15, MINNESOTA Separation



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High efficiency, low cost centrifugal dryer. There are no gears to become noisy, wear out, or require frequent replacement. There are no belts or flexible couplings.



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The McNally Pulso is an up-draft type thermal dryer. It solves thermal drying's most difficult problem in the ½" to 0" range. Moisture is evaporated 100% without a drop of effluent. Surface moisture can be controlled to meet specifications.

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LITERATURE . . .

Tefion Products.....Illustrated booklet,
"The Best in Tefion," covers data on
tefion parts & products—bellows, bellows connectors, pump & valve packings, tubing & other molded forms.
12 p. Chemion Catalog.
347a "Crane Packing Co.

Turbines, Steam.....Turbines range from 150 horsepower down to fractional in 6 frame sizes. Feature large number of manually operated valves for individual control of steam nozzles. Details in Bullettin 135.

27 *Coppus Engrg. Corp.

Handling & Packaging

Conveying Systems.....Select and apply right system for conveying dry, pulverized and granular materials efficiently and economically. Illustrates and describes four conveying systems in Bulletin No. G-1.

48

Conveyor-Elevators.....Company's compact Redler units are ideally suited for handling food products, chemicals, wood chips, coal and numerous other materials. For complete information refer to illustrated Catalog 140, 88 *Stephens-Adamson Mfg. Co.

Conveyors, Natural-Frequency.....Work on unique, patented vibrating princi-ple which permits them to handle many materials too tough for most screw, belt, apron, vibrating, etc. con-veyors. Data in Bulletin 111. 213 *Carrier Conveyor Corp.

Dischargers, Circular Bin.....Prevent arching or clogging of bulk materials in bins with an S-A circular bin dis-charger fitted with a revolving arch breaker. Find complete details in de-scriptive Bulletin No. 250. 450A Stephens-Adamson Mfg. Co.

Dumpers, Drum.....New Data Sheet covers company's portable drum dumper for mechanically elevating and emptying containers into high-walled receptacles. Illustrations and technical details of its operation.

450B Gifford-Wood Co.

Elevators.....Are made for service—
every part is designed for continuous
and trouble-free operation. Complete
data on elevators of accessible "One
Man, One Minute" designs in illustrated Bulletin.
4500 Sturtevant Mill Co.

Feeders, Rotary.....Describes the new, completely sealed rotary feeder for pressure or vacuum feed & the standard unit employing brass half seals for normal feed. Bulletin includes plan and elevation drawings.

450D Beaumont Birch Co.

Feeders, Wet Reagent....Accurately meter minute quantities of liquid from 0 cc to 2000 cc per minute. Float valve in tank permits connection of feeder to bulk storage device. Data in Bulletin F6-B9.

354d *Denver Equipment Co.

Idlers, Suspension.....Covers neoprene belt conveyor idler of cable suspen-sion type which resists most chem-icals, has excellent resistance to abrasion, does not deteriorate in oil, etc. Bulletin No. LD-103. 450E Joy Mfg. Co.

Magnets.....Describes the line of electric and non-electric magnets for installation in, on or above material conveying systems and integration with processing machinery. Full details in Catalog C-5000-B.

165a *Dings Magnetic Separator

mets, Grate.....The Eriez grate magnet prevents tramp iron damage to valuable equipment . . . and pre-vents product contamination to free-flowing foods, chemicals, etc. Re-quest detailed Bulletin B-204. 34a *Eriez Mfg. Co. Magnets.

* See explanation on p. 440

- Pulleys, Magnetic.....New reference includes applications, features, diagrams, performance data, specifications and a guide for selecting the proper size. Request this valuable 8 p. Bulletin No. PY-260.

 451A Homer Mfg. Co.
- Bamps.....New 4 p. Booklet features complete engineering details & other information concerning the use & installation of hydraulic adjustable ramps for loading docks. Two types described & illustrated. 451B Rowe Methods.
- Scales.....In company's complete line there is a modern answer to every problem of industrial weighing—in standard, or in custom-built units. For full details, request new Condensed Catalog No. 2001.

 Toledo Scale Co.
- Scales, Bagging.....Complete details on improved GGG-38 bagging scales. Includes lists of 7 specifications and 5 features plus a photograph of the unit and a dimensioned engineering drawing. Data Sheet No. 5401.

 451D Richardson Scale Co.
- Storage Methods....."How to Double Your Warehouse Capacity" suggests sizeable savings of space & time are possible thru better use of existing facilities & use of special storage equipment. 16 p. Catalog 700.

 451E Frick-Gallagher Mfg. Co.
- Tanks, Glassed Steel.....Tells how you can store chemicals at an original investment as low as 25¢ per gallon, with new "Chemstor" glassed steel tanks, and offers data on all sizes, in descriptive Bulletin 918.

 451F Pfaudler Co.
- Trucks, Fork.....Presents two new circulars describing the Model "M"—a high lift electric straddle type fork truck. Designed for 6'-0" aisle operation, available in "articulated" & "narrow" styles. Illustrated.

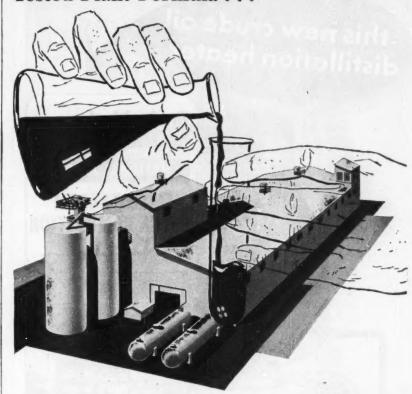
 451H Lewis-Shepard Products.
- Trucks, Industrial, Aluminum.....Company announces the availability of a new. illustrated Data File which describes the weight, flexibility, and caster advantages of their line of aluminum industrial trucks. 4511 Magnesium Co. of America.

Heating & Cooling

- Boilers.....Numerous valuable features make self-contained boilers first choice for commercial, institutional and industrial applications. In sizes 15 to 500 hp, 15 to 250 psi. Details in Catalog No. AD-100.

 59 *Cleaver-Brooks Co.
- Boilers.....Illustrated, 32 p. contains latest, most authentic and complete information on entire company line of high and low pressure steel boilers for commercial, industrial and residential use. Catalog No. 80. 451J Kewanee-Ross Corp.
- Burners.....Completely illustrated, 28 p. describes line of industrial oil & gas burner equipment for all types of furnaces & kilns. Covers liquid fuel atomizers, gas burners, air registers, etc. Bulletin OB-53. Engineer Co.
- Burners.....Describes line of combination oil and gas burners for radiant tube firing in controlled atmosphere furnaces. Includes data on features, capacities, dimensions, etc., in Illustrated Data Sheet No. 1-415. 451L Hauck Mfg. Co.
- * See explanation on p. 440

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INDUSTRIAL OIL BURNERS. GAS BURNERS, FURNACE EQUIPMENT

LITERATURE . . .

- Chillers, Liquid Advantages shown for Thru-Tube construction include: controlled high refrigerant velocity, low refrigerant pressure drop, positive oil return, etc. Full details in 8 p. Catalog No. 600.

 4524 Acme Industries.
- Chillers, Liquid..... Designed for air conditioning & industrial application, line of liquid chillers range from 7½ to 150 hp in a variety of models & combinations. Details in illustrated Bulletin C-1100-B52.

 452B Worthington Corp.
- Condensers, Barometric.....Condensers are designed to produce a high vacuum, condense steam, and remove air and other non-condensable gases. For complete information on company's line, request Bulletin No. 5-AA. 452C Schutte & Koerting Co.
- Condensers, Sea-Water.....Detailed bulletin provides information concerning company's double-tube, counter-flow sea-water condenser...for marine use and all other "bad water" conditions. Bulletin No. C-4. 452D Halstead & Mitchell.
- Condensers, Steam.....Company's latest & revised 24 p. Catalogue features informative sections on: installation; engineering; air removal equipment; maintenance; steam condenser specialties; etc. Illustrated. 452E Condenser Service & Engrg.
- Coolers, Air-Quenching.....Information on how savings can be effected in the cement, lime and chemical industries through use of an air-quenching shaking grate cooler. Details in illustrated Bulletin No. 07B7869. 161a *Allis-Chalmers Mfg. Co.
- Coolers, Cascade.....Designed for cooling corrosive liquids and gases. Low initial cost and maintenance, radiused returns for low pressure drop as well as redwood waterguide strips. Request Catalog No. S-6820.

 225d *National Carbon Co.
- Drainers, Multiport.....Ball float type traps for automatic, continuous drainage of steam, air, gas lines or equipment under vacuum or positive pressures up to 200 psi. Find details in Publication Nd. 5201.

 452F Cochrane Corp.
- Heat Exchangers.....Describes how equipment offers: chemical resistance to practically all corrosive fluids; resistance to severe thermal shock; high heat-transfer rates; low maintenance; etc. Catalog S-6740.

 225e *National Carbon Co.
- Heat Exchangers.....Your heat exchanger problems will be handled completely and efficiently . . . with National's line of shell and tube heat exchangers. Supplies complete information in Bulletin No. HT-654.

 452G National Radiator Co.
- Heat Exchangers, Tube Bundle.....New standardized heat exchanger design features lower first cost, more area per unit, choice of tube lengths, faster delivery, etc. Company offers full details in Catalog S-6840.

 225f *National Carbon Co.
- Heat Transfer Equipment..... Provides heat transfer equipment for the most exacting services in petroleum refineries, chemical plants, and related industries. Bulletin describes the wide range of equipment.

 80a *Henry Vogt Mach. Co.
- Heaters. Jet.....Valuable information on SK low pressure, high capacity jet heaters... designed to provide large quantities of hot liquid (usually water) for delivery to tank or reservoir. Bulletin 3A-HC. 452H Schutte & Koerting Co.
- Heating Systems, Dowtherm....Furnishes descriptive information on Dowtherm heating systems for processes requiring precision control of high constant temperatures at low pressures, in Bulletin ID-54-5.

 127 *Foster Wheeler Corp.

* See exp'anation on p. 440

- Heating Units, Electric.....Literature describes methods of electrically heating liquids, air, gases, machine parts, process equipment. Illustrated 32 p. booklet, "101 Ways to Apply Electric Heat," No. F1550.

 36 *Edwin L. Wiegand Co.
- Humidity Conditioning Presents methods for eliminating condensation & resultant equipment corrosion in filtration plant pipe galleries & wash water pump rooms, in a new, 4 p. illustrated bulletin, Form K-354.

 453A Surface Combustion Corp.
- Platecolls.....Designed for tank heating and cooling problems due to inefficient pipe colls. These cost-saving platecolls heat or cool 50% faster and take 50% less space in the tank. Offers Bulletin No. P61.

 58
- Towers, Cooling...... "Studies Relative to Protection of Cooling Tower Lumber" covers results of program conducted with govt'l. laboratory to learn more of causative factors & methods of controlling decay.

 453B Marley Co.
- Towers, Cooling......34 p. profusely illustrated reference furnishes valuable information relating to line of induced draft cooling towers for industrial and air conditioning applications. Request Bulletin 4.9.080.
 4530 J. F. Pritchard & Co.
- Traps, Ball Float.....Describes ball float traps for draining water from air, gas or steam lines or for draining light liquids from gas under pressure. Physical & selection data, prices, etc. Bulletin No. 289.

 453D Armstrong Mach. Wks.
- Traps, Steam.....Company makes available a descriptive 44 p. Steam Trap Book which furnishes complete trap data and prices plus useful selection, installation and maintenance information. Request Catalog "J."

 52 *Armstrong Mach. Wks.

Instruments & Controls

- Cells, Conductivity..... Industrial Instruments manufactures a complete line of conductivity cells with models for every application. Covers conductivity measuring and control equipment in Catalog No. 20.

 1 Industrial Instruments.
- Control Units.....Information on control used to treat water electrically for prevention of hard scale formation in all types of equipment which use or are cooled with water. Illustrated Bulletin No. 200R.

 453F Aqua Elec. Scale Control.
- two-position recording controller—a new concept in instrumentation. Complete details in pictorial fold-out which takes you inside the instrument. Die-Out ND46(1).

 28-9 *Leeds & Northrup Co.
- Controls, Indicating.....Tells how mercury actuated indicating controls have been engineered with specific advantages for maximum efficiency in specific applications within -30°F to 1200°F range. Catalog CC.

 453G

 Partlow Corp.
- Controls, Liquid Level.....Unaffected by surface agitation, equipment vibration, roll of a ship—a simple design offering steady, positive, precise control even under extreme conditions. Descriptive Data PC-37.
- Controls, Temperature Describes the Fenwal liquid-filled, snap-action Thermoswitch unit . . one of the newest additions to the wide range of industrial temperature control & detection devices. Bulletin MC-120.

 4531 Fenwal, Inc.
- See explanation on p. 440

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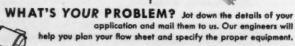
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LITERATURE . . .

- Electronics, Industrial Company's new 1955 general catalog contains 308 p. listing over 25,000 items. Special emphasis has been placed on equipment for industrial maintenance, research and production requirements.

 454B Allied Radio Corp.
- Gages, Liquid Level.....Completely illustrated 76 p. reference describes the entire line of Penberthy liquid level and water gages... and also indicates their numerous points of superiority. Request Catalog 35.

 44 *Penberthy Injector Co.
- Instrumentation for Absorbers.....Decsribes operation & instrumentation of Karbate standard falling-film type absorber — principle of operation, method of operation, applications, etc. Data Sheet No. 2.5-11. 4540 Minneapolis-Honeywell.
- Instrumentation, Process.....Presents a new 12 p. general catalog with numerous illustrations, descriptions, and basic specifications of company's complete line of process instrumentation. Request Catalog No. 1.

 454D Fischer & Porter Co.
- Instrumentation, Rotary Kiln.....Covers basic problems in measuring & controlling temperatures, pressure, burner fuel, speed & exhaust gas in rotary kiln operation. Request illustrated Data Sheet No. 1.1-2.

 454E Minneapolis-Honeywell.
- Measurement, Smoke Density.....Covers the MSA Smokescope... an optical instrument specifically designed for estimating density of smoke in stack effluent. Includes construction and operation. Bulletin No. 0811-3. 454F Mine Safety Appliances Co.
- Meters.....Describes the Alnor Velometer—a precision-built, self-contained, portable instrument which gives instant, accurate readings of air velocities anywhere, Full details in Bulletin No. 2448-G.

 Illinois Testing Labs.
- Meters, Liquid.....Valuable reference describes many new meters for industrial liquids. Included are Auto-Stop quantity control meters, Auto-Switch meters, Print-O-Meters, etc. Illustrated Bulletin 567. 454H Neptune Meter Co.
- Precipitators, Thermal Compact thermal precipitator for aerosol sampling—a valuable instrument for: air pollution surveys; smoke abatement records; control of dust & fume exposures; etc. Complete details. 4541 Joseph B. Ficklen, III
- Pyrometers, Millivoltmeter.....New bulletin covers complete line of millivoltmeter pyrometers & accessories. Includes new Model 580 indicating pyrometers for service up to 4000°F. Illustrated Bulletin No. P1244.

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- Becorders.....Offer valuable features:
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 18 **Bailey Meter Co.
- Hegulators, Oil-Air Ratio.....Describes Hauck oil-air ratio regulator ... an automatic & simple means of proportioning oil & air to industrial burners of the two-air connection type. Illustrated Bulletin 722.

 454K Hauck Mfg. Co.
- Spectrophotometers.....New 16 p. catalog describes performance, construction, specifications, accessories and modifications on Model 11 and Model 14 Cary recording spectrophotometers. Bulletin No. P53.

 Applied Physics Corp.
- See explanation on p. 440



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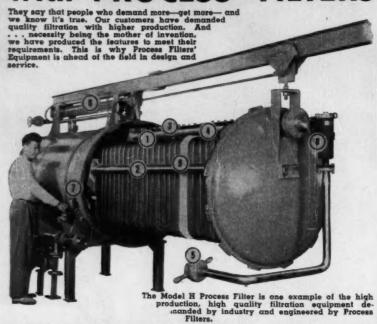
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Testers, Thickness.... Describes portable, battery - operated instruments for measuring thickness of a wide variety of metals, glass, rigid plastics, etc., nondestructively from one side of the work. Catalog No. A2.

456A Branson Instruments.

Transmitters, Time-Pattern Lista complete specifications of instrument which positions set point indices of one or more instruments according to a definite time-pattern. Specification Sheet No. 287-1.

456B Minneapolis-Honeywell.

Pipe, Fittings, Valves

Caps & Plugs, Polyethylene..... Easy-to-apply caps & plugs of tough, flexible polyethylene offer inexpensive protec-tion for tubing, valves, fittings, hy-draulic components & many machined parts, Illustrated. 4560 Protective Closures Co.

Connections, Pipe.....12 p. combination engineering manual & catalog covers new Graloc line of Universal pipe connections, unions & bleeder valves. Includes construction, operation, bene-fits, specifications, etc.

Gray Tool Co.

Couplings, Crown.....Describes company line—includes illustration showing exploded view of coupling & a table containing data necessary to select correct coupling for a given application. Bulletin No. 2203.

456E De Laval Steam Turbine Co.

Faucets, Stainless Steel.....Describes and illustrates a new corrosion-resistant stainless steel, fume-tight sanitary faucet with KEL-F sealing rings. Covers advantages, design, materials of construction, etc.

456F Economy Faucet Co.

Fittings.....Offers Klinger Master Catalog describing the complete range of products ... compressed asbestos sheet packings for all purposes, valves, cocks, level gages, synthetic and silicone rubbers, etc.

71a *Klinger Corp. of America

Fittings, Stainless Steel.....New stainless steel fittings will assure you of long, trouble-free service in tough piping applications . . will reduce down-time and cut maintenance costs. Bulletin No. S-3-55.

4566 Watson-Stillman Fittings

Fittings, Tube.....Complete, new Tech-nical Data Catalog describes entire line of Koncentrik stainless steel flared tube fittings. Includes informa-tion, on application, installation, per-formance, etc. 456H Special Screw Products Co.

Hangers, Pipe.....With the Blaw-Knox functional spring hanger, you can readily control both lateral & longi-tudinal swing movements of hanger rod up to 7 degrees. Contains full in-formation in Bulletin No. 54. 4561 Blaw-Knox Co.

Hose, Metal, Flexible......Ideal for diffi-cult fluid and gas handling jobs. Durable and leak-proof for convey-ing, controlling movement and vibra-tion, correcting misalignments, etc. Full details in Bulletin No. 20D. 22 *Atlantic Metal Hose Co.

* See explanation on p. 440

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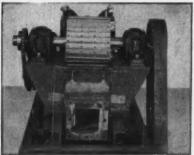


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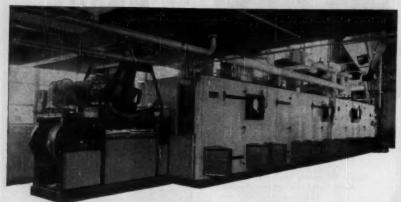
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 458A Thermoid Co.
- Joints, Ball Ball joints are employed where low cost, leakproof, movable joints are needed in piping handling steam, air, oll, water, gas or chemicals. Many models available. Full details in Catalog No. 215A. 278a *Barco Mfg. Co.
- Joints, Revolving..... Superior design of these Barco revolving joints insures trouble-free performance, minimum roll drag, & up to 50% power savings. Ratings to 250 psi (steam); 450° F. Catalog No. 300A. 278b Barco Mfg. Co.
- Joints, Revolving.....Describes high speed revolving joints for clutches, chucks and machine tools. Easy to install where space is limited; economical. Precision built for rugged service. Catalog No. 307.

 *Barco Mfg. Co.
- Joints, Swing..... Especially designed to provide for the necessary, movement & flexibility in metal pipe loading or unloading lines which handle petrochemicals, oil, alcohol & other fluids. Request Catalog No. 400. 278d
- Joints, Swivel.....Company produces a complete line of high pressure hydraulic swivel joints for use with small diameter tubing or pipe. Full details furnished in illustrated reference, Catalog No. 289.

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- Joints, Swivel.....These self-aligning swivel joints offer highest flexibility in piping. Specifications, dimensions, application data for entire line. 14 styles & 8 sizes available. Data in Catalog No. 265A.

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- Pipe & Fittings.....For corrosion-resistant piping. Impervious graphite pipe & fittings readily installed, long lasting, easily maintained, unaffected by most corrosive fluids. Request Catalog No. S-7000. 225b National Carbon Co.
- Pipe & Fittings, Glass.....Glass pipe & fittings for full-scale production operations. Strengthened by end-tempering & feature corrosion-resistance, non-contamination, etc. Catalogs EA-1 & EA-3 offer full details.

 221a *Corning Glass Wks.
- Pipe Installation, Glass.....Pipe is easy to install & low in installed cost compared with other corrosion-resistant materials. Available in 6 standard sizes grom 1- to 6-inch. I. D. inclusive. Installation Manual No. PE-3. 221b *Corning Glass Wks.
- Pipe, Saran.....An old stand-by with many new uses—oderless, tasteless, general-purpose rigid pipe & semifiexible tubing. Highly resistant to most chemicals. Find complete details in Bulletin No. 351. 351b *American Hard Rubber Co.
- Pipe, Steam Traced.....Alcoa's new steam traced pipe saves 30% of labor costs, reduces material and insulation costs over conventional steamjacketed lines. Makes available descriptive booklet, "Unirace." 241 *Aluminum Co. of America
- Piping for Industry.....Complete prefabricated piping systems for all pressures and temperatures . . . plus a full line of functional spring hangers, constant support spring hangers, etc. Bulletin No. 2443. 66 *Blaw-Knox Co.
- Tubing.....Publishes general tubing catalog which condenses into 8 p. the pertinent information needed for the selection and application of 46 principal analyses of tubing. Bulletin No. 40 available upon request.

 458B Superior Tube Co.

April 1955—CHEMICAL ENGINEERING

* See explanation on p. 440

Tubing, Metal, Flexible....There are hundreds of applications in the steam and diesel power fields for Penflex Interlocked tubing and Penflexweld High-pressure tubing. Request your copy of "Flexineering."

72 *Pa. Flexible Metallic Tubing

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- Unions, Forged Steel.....Describes line of new forged steel unions. Presents complete dimensions of unions in sizes &" to 2" in 3000 lb. class. Also covers outstanding design features. Illustrated Bulletin U-1.

 459A Watson-Stillman Fittings.
- valves.....Describes the new Type "M"
 valves... for the toughest service—
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 and other corrosives too severe for
 the stainless alloys. Full details in
 Bulletin V/8.
 *Duriron Co.
- Valves.....Completely new 64 p. reference describes company valve linencedle, globe, plug, relief, check, etc. Includes construction details, dimensions, specifications, & ordering data. Request Catalog 654.

 459B Republic Mfg. Co.
- Valves.....There's a hard rubber, rubber-lined or plastic-lined valve for every corrosion application. Sizes from 2" to 24". Diaphragm, gate & check types. Chemicals that can be handled in Bulletin No. CE-52. 351a *American Hard Rubber Co.
- Valves.....Covers line of tight-closing rubber-seat Butterfly valves. Includes data on advantages, sizes, pressures, velocities, operators, positioners, etc. Photos & details of components. Bulletin No. 650-L1. 459C Builders-Providence.
- Valves, Control.....Describes the "Red Jacket" valve...a new type of control valve...for handling solids in suspension. Covers principle of operation, construction features & advantages, etc. Illustrated. 459D Red Jacket Co.
- Valves, Diaphragm.....Diaphragm in packless valves does one job only sealing bonnet. Independent disc does seating—saves wear & tear on diaphragm—permits closure of valve even should diaphragm fail. 325
 *Crane Co.
- Valves, Diaphragm Control.....Complete information on company line of diaphragm control-valves in K&M Valve Engineering Data Catalog, Bulletin CV53. Also provides the new Valve Size Slide Rule Calculator.

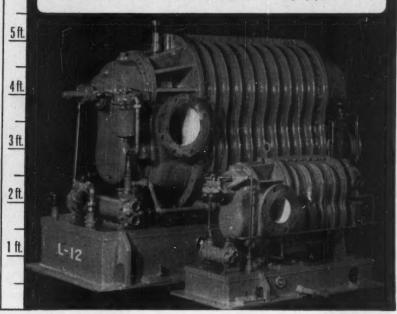
 219 *Kieley & Mueller
- Valves, Gate.....Describes major stainless steel gate valves in company's line. Includes schematic drawings; section on design factors; discussion of construction materials, standards; etc. Bulletin 55G. 459E Cooper Alloy Corp.
- Valves, Mud.....Describes Mudwonder alloy steel valves—designed primarily for mudline service in the oil drilling industry but also suitable for other abrasive fluid applications. Illustrated Catalog No. 12-S.

 Edward Valves.
- Valves, Relief.....Bulletins cover new
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 4596 A. W. Cash Valve Mfg. Corp.
- Valves, Solenoid.....Fully diagrammed, 8 p. details line of cushioned solenoid operated valves. Includes construction, operation, installation, servicing, dimensions, specifications, parts list, etc. Bulletin W-7. 459H Golden Anderson Valve.
- Valves, Solenoid.....Illustrates and describes the new direct lift solenoid valves made in brass (Type F) and stainless steel (Type G)—1° and 1° pipe sizes, with ports from 1° to 1°. Bulletin No. F-1,

 Bulletin No. F-1,

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- * See explanation on p. 440

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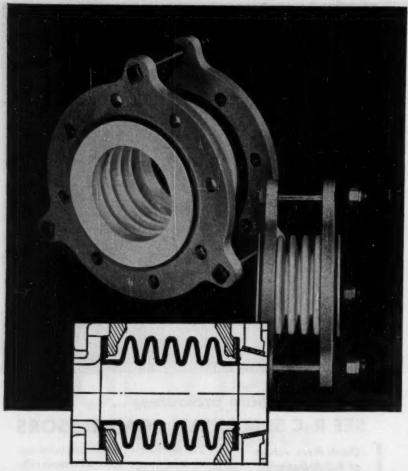
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Agitating Equipment.....Presents an 8 p. fully illustrated reference covering Nettco side drive with shut-off. Describes how the shut-off operates, numerous advantages, exclusive features, etc. Bulletin No. 532, 401a *New England Tank & Tower.

Airtube Systems..... Describes the newly developed "packaged" Lamson Airtube System for fast, efficient pneumatic tube connection of any 2 points up to 130 feet apart, in 4 p. fully illustrated Bulletin.

460A Lamson Corp.

Blenders, Botary Batch.....Offers complete information on special selfcleaning batch blenders or mixers. Includes data on operation, construction, approximate specifications, etc. Illustrated Bulletin 080B. 460C Sturtevant Mill Co.

Blending Systems.....Pictures and describes the company's new high-ratio continuous blending system. Lists features, outlines the operating sequence, and contains schematic diagram. Technical Reference No. 54D.

460D Richardson Scale Co.

Caps, Bubble.....Offers extensive compilation of engineering and construction data. Contains complete specification information for more than 200 standard styles of bubble caps and risers. Bulletin No. 21. 460E Pressed Steel Co.

Centrifuges.....There are extra profits from slurries when high-centrifugalforce Super-D-Canter, with its internal screw conveyor action, separates sollds from liquids. Find details in Bulletin No. 1254. 137

ClassifiersAll classifiers (Rake Type, Spiral, Hydro) are designed to efficiently separate fine particles in specific applications. For complete information on company's line, request Bulletin C5C-B. 354b *Denver Equipment Co.

Crushers, Jaw.....Cast steel frame, manganese jaw & cheek plates. Large diameter shafts reduce shaft deflection & thus increase life of heavyduty, oversize roller bearings in bumper. Bulletin No. C12-B12.

354e *Denver Equipment Co.

Den & Excavator.....Unit forms inexpensive, complete, efficient means for producing a superior, bulky, yet granular, superphosphate in excellent mechanical condition for use as a fertilizer. Bulletin No. 089.

460G Sturievant Mill Co.

Dryers.....Designed to dry air to subzero dew points at low cost. Available with manual, semi-automatic, or fully automatic tower reactivation. Complete facts and technical information in Bulletin D-27.

37 *C. M. Kemp Mfg. Co.

* See explanation on p. 440

- Dryers.....Available in several types:
 direct heat, indirect heat, and steam
 tube. Let Deco engineers help solve
 your drying problem—no dryer problem too small or too large. Details
 in Bulletin No. D4-B2.
 3541 *Denver Equipment Co.
- Dryers.....Lectro-dryers can dry air & gases in volume to dewpoints below —100°F—can drop relative humidity lower than 10%. Bookiet describes machines & how various industries use them to gain efficiency.

 90 °Pittsburgh Lectrodryer Corp.
- Drying, Vacuum.....Company offers informative brochure, "Vacuum Drying," which contains descriptions of the techniques of moisture removal from chemicals, pharmaceuticals and other industrial products.

 *F. J. Stokes Mach. Co.
- Offers complete information on Fluo-Solids system . . . a new method of drying, sizing, or heat treating minus g inch solids under closely controlled temperatures. Bulletin 7502. 461A Dorr-Oliver, Inc.
- Dust Collectors.....Presents information on hydro-static precipitators for use in rotary kiln service. Equipment offers high collection efficiency on even small micron particle sizes. Bulletin No. 277. 73 *American Air Filter Co.
- Dust Control.....New booklet on dust control in pharmaceutical manufacturing. Three illustrated case histories cited, covering dust control at tablet presses, packagers, mixers, dryers, etc. Bulletin 550-D.

 461B American Wheelabrator.
- Dust Control.....Pangborn engineers help solve your dust problems—line of wet or dry dust collectors can save time, trouble & money. See how varied industries are benefited in "Out of the Realm of Dust."

 337 *Pangborn Corp.
- Dust Filters.....Compact, versatile, simple to operate and provide readymade answer to many industrial dust problems. Complete details on new fiber dust filter, Type FD, in illustrated Bulletin No. F-9053.

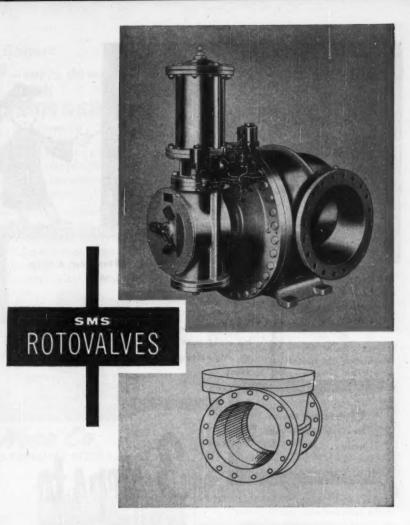
 461C Ducon Co.
- Dust Recovery.....New profits in terms of valuable dust that can be returned to production rather than wasted in the air. Presents an informative Brochure which describes three systems of industrial dust recovery.

 93

 *Buell Engrg. Co.
- Ejectors.....Steam jet air ejectors for modern, efficient, low-cost air removal from condensers. Covers principle of operation, ejector classification, interafter condensers, accessories, etc. in illustrated reference. 461D Condenser Service & Engrg.
- Eliminators, Mist.....More effective & economical entrainment separation . . . with the new Metex Hi-Thruput herringboned mist eliminator. Covers operation & performance in illustrated Metex Bulletin ME-5.

 461E Metal Textile Corp.
- Extruding Machines.....32 p. booklet
 "Farrel-Birmingham Screw-Type Extruding Machines," describes & illustrates plasticators, pelletizers, extryders, strainers, strainer-extruders,
 etc. Bulletin No. 195.
 461F Farrel-Birmingham Co.
- Filter Units.....Announces the design, manufacture & sale of a new series of cartridge type filter units designed especially for the electroplating & electroforming industries. Details in illustrated Brochure.

 4616 Comco, Inc.
- Filters.....Designed for fine filtration or clarifying purposes ... operate on simple 3-step principle of precoating, filtering & backwash cleaning. Covers operation & function in fully illustrated Bulletin F-55. 461H Cross-Reynolds Engrg. Co.
- * See explanation on p. 440



LESS HEAD LOSS MEANS LOWER PUMPING COSTS

Free, unobstructed flow through SMS-Rotovalves means a lower head or pressure loss, helps you keep pumping costs down. The full line opening shown in the drawing above offers no more resistance than a straight piece of pipe of the same diameter.

Rotovalve design solves many control problems. The conical plug first lifts, then rotates and finally reseats. You get easy operation, precise aperture control, controlled closing time, tight and positive closing, easy mechanical cleaning, low maintenance, long life.

These high-performance characteristics are the result of over 75 years of engineering and research experience in the hydraulics field. For detailed information on Rotovalves, contact our local representative or write to the S. Morgan Smith Company, York, Pennsylvania.

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AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO



You can eliminate pump down-time by standardizing on Sealol-Flexibox Mechanical Shaft Seals. Flexibox replaces the conventional stuffing box; it eliminates shaft sealing maintenance; it guarantees long life to the

Where is Flexibox being used today? Applications include pumps handling acids, hydrocarbons, chlorinated hydrocarbons, esters, ketones, alcohols, slurries, salts, antibiotics, and many other materials.

Find out about maintenance-free pumping . . . let us make a test installation on one of your pumps. Write today for data and recommendations, or send for Bulletin 10 giving complete details.

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pump shaft and sleeve.

BALANCED PRESSURE SEAL

LITERATURE . . .

Filters, Bin Vent.....New reference describing the Type UFV Bin Vent Filter is made available by company ... designers and manufacturers of dust collection equipment. Fully illustrated Bulletin F-2053.

462A Ducon Co.

Filters, Disc..... Special, patented design of segments in filters use both gravity & vacuum to give a drier filter cake. Drainage is complete & positive with no blow-back. Details contained in Bulletin F9-B2.

354e Denver Equipment Co.

Filters, Horizontal.....Describes line of horizontal rotary vacuum filters in sizes from 3 ft. to 12 ft. diameter. How it works, operating advantages, applications, specifications, etc. Request Bulletin No. 202.

462B Filtration Engrs.

Filters, Pressure Leaf.....For flow rates two to five times greater than cloth covered presses; positive removal of all suspended solids to desired degree of clarity; etc. Find complete details in new Catalog NC-1-53. 207 *Niagara Filters Div.

Generators, Inert Gas.....Feature "Big
4" essentials—compact units, portable
or stationary; choice of gas or liquid
fuels; low cost per cu. ft. of capacity;
little supervision or maintenance.
Bulletin 100-B-14.
4620 Roots-Connersville Blower.

High-Pressure Equipment Equipment described in new reference embraces pilot plants, reaction vessels, fittings, valves, tubing, pumps, compressors, pressure balances, instruments, etc. Catalog No. 406.

462D American Instrument Co.

Laboratory Equipment.....Batch and continuous test models of crushers, screens, ball mills, pulverizers, rod mills, classifiers, agitators and mixers, pulp distributors, feeders, etc. Data in Bulletin LG3-B10.

354h *Denver Equipment Co.

Mills, Ball.....A steel-head ball mill will suit your particular need. Five types of discharge trunnions. Alsteel construction. Low initial cost due to quantity production. Quick delivery. Bulletin No. B2-B13.

364b *Denver Equipment Co.

Mills, Hammer.....Swing-sledge mills & hinged-hammer pulverizers built for reduction of soft, moderately hard & tough or fibrous substances to any degree of fineness ranging from 1 in. to 20 mesh. Bulletin No. 084.

462E Sturtevant Mill Co.

Mills, Ring-Roll......Have wide applica-tion—they economically grind either hard or soft substances from 1" to 1½" in size to any mesh between 6 & 200. Description, capacities & speci-fications in Bulletin No. 079. 462F Sturtevant Mill Co.

Mills, Vertical.....Scale new heights in superfine grinding. Outstanding de-velopment is a specialized grinding unit designed to operate in a fineness range beyond limits of ordinary pulverizers. Catalog 70. 326 *Raymond Div.

Mixers.....Company makes available Confidential Mixing Data Sheet. Help-ful checklist enables you to develop a complete technical description of agitation required for your process, quickly & easily. No. B-107.

205a *Mixing Equipment Co.

Mixers......Company's line of Jumbo mixers meets every requirement imposed by heavy loads. Standard-duty mixer is equipped with two roller bearings mounted on heavy fabricated supports. Request Bulletin No. 800.

345 *J. H. Day Co.

Mixers..... Makes available a valuable reference describing the complete line of Nettco tank top, side entering, and pipe line mixers, and Nettco agitator accessories. Request illustrated Bulaccessories. Request illustrated bul-letin No. 530. 401b *New England Tank & Tower.

• See explanation on p. 440

All you lift is your finger!

Production UP—costs down with

G-W's DRUM DUMPER

portable . . . semi-automatic . . . strong

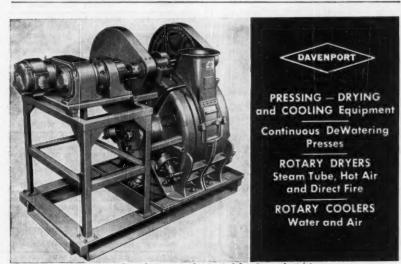
Production's up — with the press of a button — when a rugged G-W Drum Dumper is lifting and automatically dumping your drums.

Various heights to suit specific handling conditions. Units for any type and size drums. Heavy steel frame. Long-life truck casters for easy moving. Available with dust-control spout, as shown here.



Write for G-W's idea book on engineered materials handling systems.

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Streamlined Integral Variable Speed Drive

"DAVENPORT" CONTINUOUS DE-WATERING PRESS

For years "Davenport" Continuous De-Watering Presses have proven the most efficient and economical method of extracting excess moisture from various types of materials.

Write for illustrated catalog A, showing available sizes and typical installations. For quick reference, see your 1954 or 1955 Chemical Engineering Catalog.

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SOLVES YOUR STEAM PROBLEMS



A COMPLETE PACKAGE

Completely factory-assembled and tested, a Superior Steam Generator is backed by undivided responsibility.

INDUCED DRAFT THAT'S BUILT-IN

...eliminates need of an expensive chimney...Multiple fans draw evenly on all tubes, reducing maintenance.

4-PASS, DOWN-DRAFT DESIGN

High gas velocities produce high efficiency. Down-draft design promotes rapid evaporation, quicker steaming.

AMPLE HEATING SURFACE

A minimum of 5 sq. ft. of heating surface per boiler horsepower assures maximum efficiency at full rated capacity.

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Greater steam space and large evaporating surface provide ample reserve capacity & better than 99% dry steam.

NO EXPENSIVE FOUNDATION

Built on a rigid channel iron base, a Superior Steam Generator needs only a floor capable of supporting its weight.

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All controls essential to completely automatic operation are factory-wired into an easily accessible control panel,

BURN OIL, GAS, OR BOTH

Superior Burners burn oil or gas or a combination of both...changing from one fuel to the other in seconds.

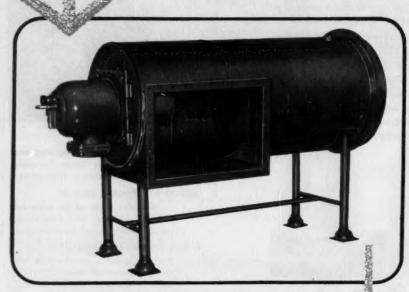
18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for Catalog 622-F. Water Tube types up to 40,000 lbs./hour write for Catalog 622-W.

for performance you can BANK on



SUPERIOR COMBUSTION INDUSTRIES INC. TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

THERMAL TYPE CA DIRECT FIRED AIR HEATERS



COMPACT . . . EASILY INSTALLED

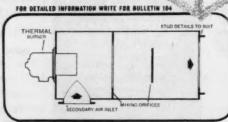
Readily fitted to ovens, kilns, spray dryers, etc., the THERMAL Type CA Air Heater is an ideal source of heat where products of combustion may be mixed with the air. Oil, gas or combination firing is available without change in heater construction.

NO REFRACTORY REQUIRED . . .

The THERMAL High Velocity Burner built into the heater permits combustion to be substantially completed within the burner itself. Thus the heater is basically a mixing chamber wherein the products of combustion are mixed with the air being heated. Refractory is not normally used. Successful applications have been made ranging from under 200,000 BTU/hr. to over 20,000,000 BTU/hr. and at all pressure levels.

UNITIZED

Initial cost and upkeep is kept at a minimum through the use of all welded, all metal construction. The CA Air Heaters are normally supplied as complete "package" installations.



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Gas, Oli & Combination Gas-Oli Burners • Heat Exchangers • Submerged Combustion • Combustion & Heat Transfer Engineering

THERMAL

Thermal Research & Engineering Corp.

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LITERATURE . . .

- Mixers....Describes Super Agitators & Mixers. Patented Standpipe around propeller shaft assures positive agitation & circulation. Patented wearing plate prevents sand-up on shut-down. Bulletin No. A2-B4.

 354a *Denver Equipment Co.
- Mixers.....Mix-Mullers for chemical and process industries. Covers Simpson mulling principle; mulling for dry, wetted and plastic mixtures; Mix-Mullers for special requirements; etc. 12 p. Bulletin No. 522. 79 *National Engrg. Co.
- Mixers, Pipe Line.....Company issues an informative booklet describing the Nettco Flomix...a patented and unique pipe line mixer for continuous processing applications. Fully illustrated Bulletin No. 531.

 401e *New England Tank & Tower.
- Mixers. Portable.....Use in industry reduces costs, saves time, labor and secures better and more refined products. Catalog includes data on construction, dimensions, specifications, etc. 28 p. No. B-108.

 *Mixing Equipment Co.
- Mixers, Proportional.....Presents valuable information on company's VariSet proportional mixer with Adjustable Jet. New selection chart gives complete specifications and dimensions. Request Bulletin L-700.

 464A Eclipse Fuel Engrg. Co.
- Mixers, Side Entering......Furnishes detailed information on features, typical applications, mechanical design, maintenance, shaft seals, methods of installation, etc. in completely illustrated Catalog B-104.

 205e *Mixing Equipment Co.
- Mixers, Top Entering.....Makes available pertinent information on topentering mixers (propeller type)... for closed tanks, pressure & vacuum... for open & loose-covered tanks. Data in Catalog B-103.

 205d *Mixing Equipment Co.
- Mixers, Top Entering.....Illustrated and detailed 32 p. Catalog includes advantages, typical installations, mechanical description, construction information, dimensions and selection tables, etc. No. B-102.

 205e *Mixing Equipment Co.
- Power Units, Hydro-Air.....Company releases 16 p. fully illustrated bulletin to give the first complete application, specification, price, and operating data on its new Hydro-Air power unit. Bulletin No. 61763.

 464B Pantex Mfg. Corp.
- Precipitators.....28 p. covers line of electrical precipitation equipment. Describes general principles of electrical precipitation, & includes sections devoted to the chief applications. Completely illustrated.

 4640 Research-Cottrell.
- Processing, Air-Gas.....Automatic protection for air and gas systems compressed air, process gases dried continuously... automatically... with Selas Dehydrator. Informative bulletins now available. 94a *Selas Corp. of America.
- Processing Equipment.....Describes corrosion-resistant processing equipment.....precision built to your specific requirements to give long years of peak performance with low maintenance. Technical Bulletins.

 339a *Lee Metal Products Co.
- * See explanation on p. 440

→ Want more information on any of these items? Just circle its code number on the postcard inside the back cover, then mail to us. It's that easy now.

THIS PLA-TANK® HOOD SAVED ITS **COST IN A YEAR**



The PLA-TANK Hood shown above has been in continuous use at General Electric's small aircraft engine department in West Lynn, Mass., for over a year. Reports indicate that it is still as good as when originally installed, is already credited with saving its entire cost since no previously used material had lasted over a year.

The tank is used for etching stainless steel billets; solutions used are aqua regia at room temperature and a 50% solution of muriatic acid at 180°F. PLA-TANK has successfully withstood these fumes, where other materials failed.

PLA-TANK products are daily solving problems of all types in the chemical and electroplating fields. They replace or outlast stainless steel, lead and ceramic linings, plywood coated with corrosion preventatives, phenolic plastics and asbestos cement board structures in many applications.

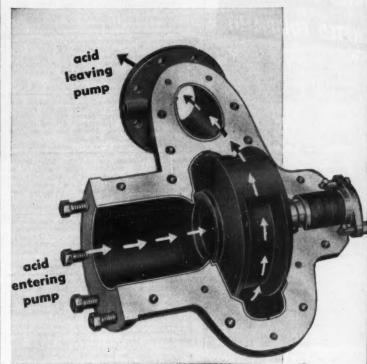
PLA-TANK, molded from long-life. resin-bonded glass fibre laminate, is now resistant to a wider variety of fumes and temperatures than ever before. PLA-TANK is light weight, easy to install, competitively priced.

Let us help you solve your problems the modern way - with PLA-TANK. Write today for free data sheets.



ACIDS CAN'T CORRODE WHAT THEY CAN'T TOUCH

THAT'S WHY BUFFALO RUBBER-LINED PUMPS SAVE MONEY



ACIDS, ABRASIVE SOLIDS RIDE ON RUBBER! Above, showing path of liquid thru "Buffalo" Type DS Rubber-Lined Pump. Hard, medium or soft rubber (depending on liquid to be handled) is vulcanized to every square inch of impeller and inside of casing.

Extra cost of rubber lining is made up for, over and over, in longer pump life, maintenance savings and avoiding of shutdowns.

THE "BUFFALO" Q FACTOR* - A PERFORMANCE BONUS.

The easily removed upper casing half of the Type DS Pump shown —its high efficiency impeller— overall sturdiness of casing, shaft, oversize bearings with large oil reservoir and ample stuffing boxall mean a best pumping buy.

WRITE FOR BULLETIN 982—see
the full line of proven "Buffalo"

Pumps for every chemical liquid ready to start saving money for you!

*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.



Buffalo Pumps, Inc.

Subsidiary of Buffalo Forge Company Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID.



I hermon, the product, and Thermonizing, the process, represent a revolutionary new concept in the science of external heat application. Thermon is a non-metallic plastic compound with highly efplastic compound with highly efficient heat transfer properties, and is easily applied in a viscous paste form over either steam traced or thermal electric systems. It completely surrounds the tracer tubing and conducts heat to the entire surface to be heated.

Definite Advantages of Thermonizing are

- LOW COST—save up to 75% over equal jacketed equipment.
 EXCELLENT HEAT TRANSFER—Exceeds steam traced equip—
- ment approximately 1100% and very closely approaches jacketed
- 3. DEPENDABILITY-no hot or cold spots.
 WIDE TEMPERATURE RANGE
- —used for sub-zero cooling or heating to 750°F. NO JACKET PLUGGAGES OR PRODUCT CONTAMINATION
- in case of equipment failure,
- —in case of equipment failure, Thermon separates product from heating medium.

 6. GOOD MECHANICAL AND THERMAL SHOCK RESISTANCE—cracking, spalling, and degradation are all nil—less than 1% linear shrinkage.

 7. ADAPTABLE—may be used with either steam traced or thermal
- either steam traced or thermal electric equipment—installed at our shops or your job location. RAPID DELIVERY—use of stan
- -use of standard equipment permits minimum delivery time.

Write for comprehensive brochure about revolutionary Thermon!

THERMON MFG. CO. 1017 Rosine • P.O. Box 1961 Houston, Texas

LITERATURE . . .

- Processing Equiparts Announces available data folder, "Pfaudler Vacuum Receivers, Dishes, Condensers, Dishes," Bulletin No. 921. Equipment, Auxiliary.....

 ces availability of a complete
 ider, "Pfaudier Glassed Steel
 Receivers, Crystallizing
 Condensers, Evaporating Pfaudler Co.
- Reclaimer Systems, Oil.....A simple, economical and efficient method of restoring contaminated lubricating and sealing oil to the full value of new oil. Offers full details on reclaimers in Bulletin No. R-160.

 335
- Reclamation Systems..... Denver reclamation systems take dollars out of your wastes—if you have valuable materials in your wastes, these systems can make recovery profitable. Catalogs & Brochures on request. 364a *Denver Equipment Co.
- Reformers, Koppers-Hasche.....Based on a unique adaptation of the cyclic heat-regenerative principle. Company announces availability of new booklet which fully describes its operation when producing heating gas.

 *Koppers Co.
- Screening Equipment.....Illustrated, 28
 p. describes line of screening equipment for efficient removal of solids
 from water, sewage & industrial
 waste. Complete dimension & specification data. Book 2587.
 466B Link-Belt Co.
- ens, Vibrating.....For fast, clean separation without blinding. Give even, smooth flow of material because of patented "true-circle" eccentric action. Two-bearing construction saves 50% hp. Bulletin S3-B11. 364f *Denver Equipment Co.
- Screens, Vibrating.....If you require a positive, dependable way to separate fine solids from liquids...the efficiency of liquid vibrating screens is your answer. Covers many design advantages in Book No. 2377.

 13 *Link-Belt Co.
- Screens, Wire.....Wire screens for vibrators are serving faithfully in daily operations in the major coal and mining centers of the world. Offers complete information on product line in Bulletins Nos. 5, 6, and 7.

 466C Cleveland Wire Cloth & Mfg.
- Separators, Air.....Air separators are machines for separating fine material from coarse material with a usual fine-product range of from 40 to 400 mesh. Complete description & specifications in Bulletin No. 087.

 406a *Sturtevant Mill Co.
- trators, Vibrating Screen.....New tangential discharge spouts replace rectangular shape spouts on SWECO vibrating screen separator. Complete information on new design contained in company's Data File No. 107-32.

 466D Southwestern Engrg. Co. Separators.
- Softeners, Zeolite.....Used for boiler feed in high & low pressure boilers, & in all industries requiring soft water. Covers sodium zeolite & hydrogen zeolite softeners in descriptive Publications Nos. 4520-B & 4530.

 466E Cochrane Corp.
- Syphons, Steam Jet.....Covers applica-tion, construction, operation & per-formance of Jet Syphons which utilize pressure energy of steam or air to pump, heat & mix liquids, gases & slurries. 24 p. Bulletin 2-A. 466F Schutte & Koerting Co.
- Tables, Concentration.....Separate materials into bands & handle coarsest sands with excellent results. Ideal for separation of groups of particles having similar range of specific gravities. Bulletin TI-B3.

 354g *Denver Equipment Co.
- Thickeners, Spiral Rake.....Simple mechanical rake and settling unit for the separation of solids from liquid is subject of a new, detailed Bulletin. Valuable features, drawings, photographs, etc. No. T5-E5.

 364c *Denver Equipment Co.
- See explanation on p. 440



HOW TO SAVE WITH CONVECTION HEATING

Here's a sure way to save fuel and space wherever a chemical process requires convection type heating. Specify "Surface" air heaters and get these returns:

Save fuel with automatically correct gas-air ratios, rapid and uniform heating, maximum volume air flow. Use natural, manufactured, or LP gas.

Save installation costs with compact design and complete air heater assembly.

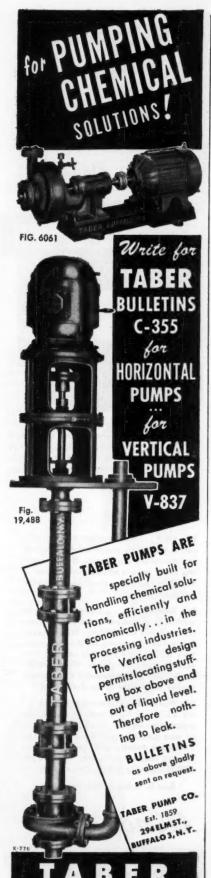
Single burner unit requires only one safeguard system for each air heater installation.

Build these savings into your convection heating equipment now. Call your "Surface" representative, or write for Literature Group H54-15.



SURFACE COMBUSTION

CORPORATION, TOLEDO 1, OHIO



Pumps, Blowers, Compressors

Compressors.....Booklet provides essential information covering company's line of Class ATH horizontal, double-acting, heavy-duty water-cooled air and gas compressors. Request 6 p. illustrated Bulletin No. 601.

467A Pa. Pump & Compressor Co.

Exhausters.....Fully illustrated, 6 p. furnishes pertinent information on corrosion-resistant exhausters for handling gases & fumes. Includes complete data on capacities & chemical resistance table. Bulletin 87.
467B

Fans.....Versatile fan for jobs up to 20,000 cfm, with quality features inlet guide vanes, curved blades, properly shaped housing & Limit-Load characteristic—for superior performance. Bulletin No. 3720. 62c *Buffalo Forge Co.

Fans.....Describes cooling tower & heat exchanger fans. Includes: visual index; adjustable-pitch fans—14' to 22'; 10' to 14' adjustable-pitch fans with Hartzite plastic blades; etc. Illustrated Bulletin A-111A.

467C Hartzell Propeller Fan Co.

Fans.....Exceptional fan equipment for industrial air & material handling features: high efficiency; rugged, tight construction; 3 interchangeable wheels—each with radial blades; etc. Illustrated Bulletin 702. 76 *Clarage Fan Co.

Fans.....New, illustrated 28 p. book furnishes tables for rapid, accurate selection of industrial fans for required capacities. Includes complete descriptive information, dimensional data, etc. Bulletin No. EX-531. 467D Bayley Blower Co.

Fans.....General ventilation—exhaust—air conditioning supply. For stable, quiet performance on large capacity work, choose the "Buffalo" Type BL Limit-Load ventilating fan. Data in Bulletin No. F-100.
62a *Buffalo Forge Co.

Fans, Vaneaxial.....The "Buffalo" Type
B Vaneaxial fans feature excellent
results in high and low temperature
applications, fume and vapor exhaust,
air conditioning supply. Request
Bulletin No. 3533 for details.
62b *Buffalo Forge Co.

Pumps.....Describes the new features of line of Rotorarm pumps—new pumping principle...new use of corrosion-resistant alloys...new uses for special jobs. Includes performance characteristics. Illustrated.

467E Hinckley Corp.

Pumps, Centrifugal......Furnishes Bulletin describing the new end suction centrifugal pump. Includes materials of construction, features of design, performance tables, dimensions, etc. Illustrated, 12 p. No. 4011.

355

Pumps, Centrifugal.....Impervious graphite pumps feature mechanical seal with enclosed coolant, rugged type SN armored connections, interchangeable parts, wide capacity range, etc. Catalog Section S-7250.

225a *National Carbon Co.

Pumps, Controlled Volume.....Covers use to control low capacity flows in continuous phosphatizing, a process in which a paint-retentive, corrosion-resistant coating is bonded to metal surfaces. Data Sheet No. C-54-1.

467F Milton Roy Co.

Pumps, Direct Flow.....Latest addition to line—2\(\frac{2}{2}\)" stroke, 25 hp direct flow Aldrich Triplex pump—embodies all famous outstanding features of design & construction—plus low cost. Furnishes Data Sheet 63.
467G
Aldrich Pump Co.

* See explanation on p. 440



No screen wear after 4½ years sizing corrosive iodide crystals

Nearly five years ago the Deepwater Chemical Company of Compton, California, asked SWECO to improve the quality sizing of potassium iodide crystals. Accurate sizing of crystals to fit different market requirements had been a problem with conventional equipment.

The product is fed to a single deck 18" dia. SWECO Vibrating Screen Separator using interchangeable 20 mesh



and 40 mesh screens. The plus-20 mesh product is supplied to the chemical industry; plus-40 mesh material goes to pharmaceutical manufacturers; and minus-40 mesh material is used in the manufacture of stock food mineral supplements.

The Deepwater Chemical Company reports that despite the highly corrosive nature of potassium iodide, the original screens are still in use and show no screen cloth wear.

Free screening analysis and recommendations... SWECO District Engineers are available to make detailed analyses and recommendations on specialized screening operations without cost to you.

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What's your GATE VALVE MORTALITY



on installations requiring frequent opening and closing?

REPLACE them

With G-A FLOWTROL VALVES

√ Use the Angle Body and Save the Price of an Elbow Fitting

✓ Built to Last a Lifetime

√ Operates with Finger Pressure



HERE'S PROOF:

One of America's large railroads had a 6" gate valve installation that operated on the average of 55 times a day. In addition to frequent repairs, this valve had to be entirely replaced every 3 months.

entirely replaced every 3 months.

In the Fall of 1947, this valve was replaced with a 6" G-A Flow-trol Valve. Now—more than 7 years later—this valve is still operating perfectly and not one parts replacement has been made!

Want to know more about this unique valve? Write for Bulletin W-8A today.

GOLDEN
ADDRESON
Calve Specially Company
1203 RIDGE AVE., PITTSBURGH 33, PA.

Designers and Manufacturers of VALVES FOR AUTOMATION

LITERATURE . . .

Pumps, Double Suction.....Rugged double suction pumps assure long life and low maintenance, Feature heavyduty construction, wide material choice, unit responsibility, etc. Offers details in Bulletin No. 08B6148 261 *Allis-Chalmers Mfg. Co.

Pumps, Process..... De Laval CPO processed pumps handle numerous liquids; salt brine; sea water; caustic solution; soap solution; etc. Capacities to 2000 gpm—heads to 200 ft. Details in Bulletin No. 1125-B.

214 *DeLaval Steam Turbine Co.

Pumps, Rotary..... Issues a new booklet on bronze rotary pumps with herringbone gears. Reference includes valuable information on diversified applications, specifications and dimensions. Bulletin W-484-B2A.

Worthington Corp.

Pumps, Rotary Vacuum.....You can reach and hold your working vacuum faster—and at lower over-all costs with Beach-Russ rotary vacuum pumps. Descriptive Catalogs furnish details of design and construction. 342 *Beach-Russ Co.

Pumps, Sand.....Soft rubber lined sand pumps lower pumping costs 30% to 70% due to simple design, lighter weight & accuracy of rubber parts which increase efficiency 1½ to 3 times over other pumps. Bulletin P9-88.

364e *Denver Equipment Co.

Pumps, Sealless.....Combining motor & pump in a single unit, Chempump is most significant advance in pump design in half a century. Hard-to-handle fluids can't leak or become contaminated. 16 p. Bulletin 1010.

310-1 *Chempump Corp.

Pumps, Vacuum.....NRC rotary gas ballast pumps keep their original high efficiency even when pumping troublesome vapors. Includes complete engineering information in company's profusely illustrated, 16 p. Bulletin. 468B Naresco Equipment Corp.

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468C Schutte & Koerting Co.

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468D Peerless Pump Div.

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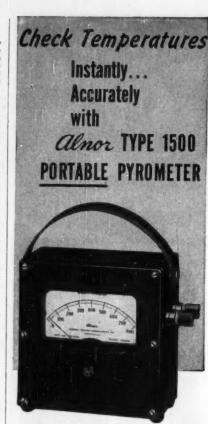
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469H General Elec. Co.

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4691 Allis-Chalmers Mfg. Co.

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469J Graver Water Conditioning.

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4691. Graver Water Conditioning.

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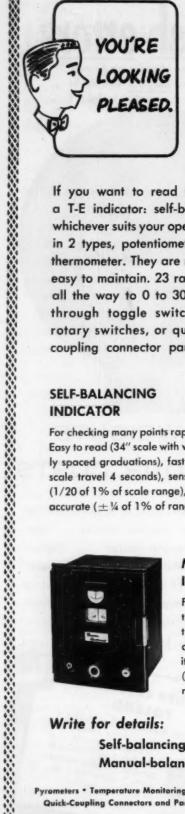
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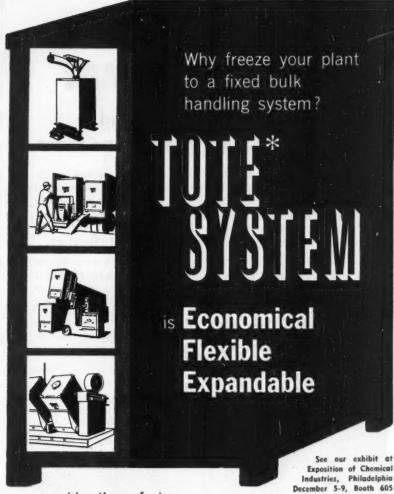
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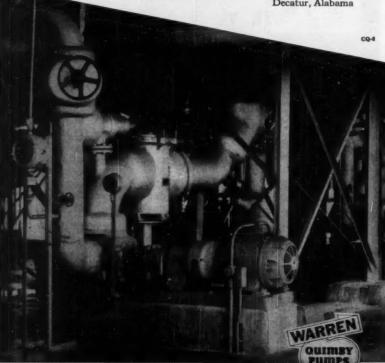
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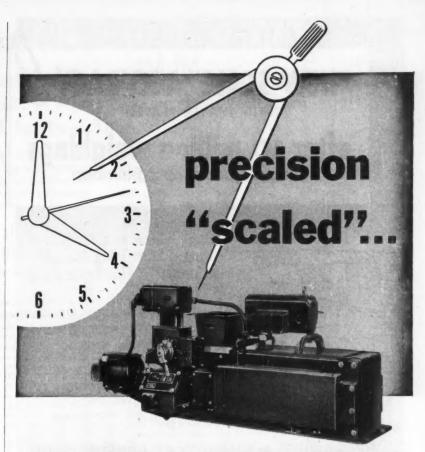
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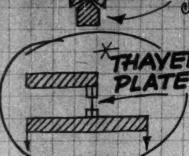
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apour	20-1d	84	92b	1470	317	250C	287e	353	369	440E	444J	451	454L	463A	409C	
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ADDS	23	59	920	148B	231b	252A	280	354b	R370	440H	445B	451C	450C	483D	489F	
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 PRODUCTS 	24-8d	62b	94b	148F	2354	254C	102	3541	877	440L	445F	451G	458G	BL463	469J	
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ADDS	23	59	920 920	148B	221b	252A	289	354b	R370	440H	445B	451C	456C	462D	469F		
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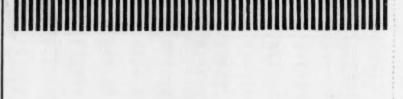
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Corrosioneering News

help you reduce corrosion and processing cost.





How Colgate squeezed "Gardol" into production

You may have brushed your teeth this morning with Colgate toothpaste, containing "Gardol." There's an important story in chemical processing

for you there. It wasn't long ago when "Gardol" was just emerging victorious from the hundreds of experimental tests that proved its effectiveness. The next step was to begin using it in Colgate Dental Cream-and to get it on the highly competitive market just as fast as possible.

Production men in Colgate's Jersey City plant were handed a schedule that would put butterflies in your

They needed equipment-fast! They stomach. rushed an order to Pfaudler for several huge glassed steel reaction kettles-big units that would take months to build from the ground up.

Under our new stockpiling program, Pfaudler was able to select the equipment needed "off the shelf" and ship it in record time.



Dr. Hal Cooper, Colgate's Assistant Research Director for development, and John Monick, Head of Organic Chemicals Division, inspect their big Pfaudler reactors.

The men in Jersey City met their "impossible" schedule, "Gardol" was soon being added to Colgate Dental Cream . . . and the rest of the success story is now marketing history.

"Inner armor" of glass prevents corrosion by acids, alkalies up to pH 12

You stop costly corrosion dead in its tracks, when you use equipment made of material that is absolutely inert to your product.

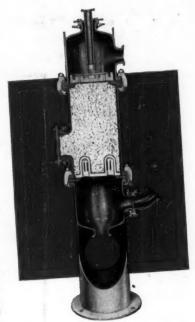
But your product may change-and you discover you need equipment that will resist a wide variety of chemicals.

Inside every Pfaudler glassed steel reactor you have a surface that resists: All acids (except hydrofluoric), and alkalies up to pH 12 at 212° F. This surface is Pfaudler acid-alkaliresistant glass-used on all Pfaudler reactors and other equipment for severe processing conditions.

Not only do you cut down on replacement costs by eliminating corrosion, but you also gain plenty of freedom in changing processes without having to buy new equipment.

Pfaudler glassed steel gives you the exceptional corrosion resistance of glass, plus the working strength of steel. Locked together by chemical action in 1700° F. furnaces, the glass and steel form a permanent bond. Under actual tests, a pull of 1500 lbs. per sq. in. would not separate them!

As in-plant economy is important to you, you'll want to know more about the exceptional resistance of Pfaudler glassed steel. Consult your Pfaudler representative, or write us for more information.



Columns like this, heat exchangers, tanks, reactors and other equipment are available in glassed steel. Operating advantages include corrosion resistance, nonadherence, easy cleaning, no catalytic effect.

Have you considered copper and its alloys?

Many problems of handling nonoxidizing acids and mild corrosives can be solved economically with copper

or its alloys. Heat exchange, for example, is often "duck soup" for copper. Evaporating pans, holding tanks, fume hoodsthese are just a few of the hundreds of items for which copper is a suitable construction material.

With the acquisition of Schock-Gusmer & Co., Pfaudler now has a complete staff of coppersmiths and full facilities to help solve your problems. Schock-Gusmer & Co. has been in the copper fabricating business for 79 years, and has built a wide range of items from huge kettles to atomic energy equipment.

Unbiased selection of materials

With the addition of copper and copper alloys, Pfaudler now has an even larger selection of materials with which to build your corrosionresistant processing equipment, including glassed steel, stainless steel, Hastelloy, Inconel, titanium and others. Let us quote on your needs.

Pfaudler

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